DOCTOR OF PHILOSOPHY

A new focus for education? Nature connection as a goal for all education Theoretical, research and practical perspectives

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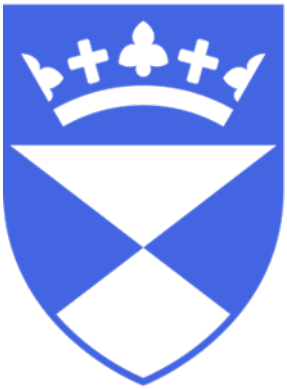

A new focus for education?

Nature connection as a goal for all education: Theoretical, research and practical perspectives

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Acknowledgements

The journey to this thesis has been a rather protracted one, yet very scenic in many ways! I have been incredibly lucky to be able to undertake a PhD by Publication that has left me free to explore issues that have been of interest to me. The nature of this type of PhD has meant that it has been a more solitary and self-directed experience than most PhDs, and that I have had to seek out support from colleagues, friends and even strangers all along the way. I am extremely lucky to have been supported in this by my two co-authors, namely Dr Alexios Arvanitis and Dr Liz Lakin. Their enthusiasm, willingness to share ideas and cross-pollinate, to guide and share the trials and tribulations of the publishing process have been invaluable. I have also sought help from informal mentors throughout this process, both from within the University of Dundee, and outwith. Dr Marietta Papadatou-Pastou and Dr Jennifer Barnett introduced me to the magical world of research and have been supportive throughout – their friendship and love sustains me in all of life. Prof Tim Croudace has provided wise counsel (and soup) Dr David Booth with his help and advice in all statistical matters.

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before I was able to.

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Declaration

The candidate is the author of the thesis; unless otherwise stated, all references cited have been consulted by the candidate; the work of which the thesis is a record has been done by the candidate, and it has not been previously accepted for a higher degree. The nature and extent of the candidate's individual contribution is clearly defined.

Alexia Barrable

May 2020

Abstract

Ecological catastrophe, including the Holocene mass extinction, and the climate crisis demand that we find new ways to approach the human-nature relationship. An effective way to enact positive change is through education. Nature connection describes a positive relationship with the natural world: how we engage with it on cognitive, affective and behavioural levels and how much we feel we are a part of it. This thesis examines nature connection and its correlates, which include wellbeing, pro-environmental attitudes and ecological behaviours; and puts it forward as a focus for all education, and moving away from its current status as an assumed by-product of outdoor learning, starting with early childhood and spanning across to higher education. Grounded in Self-Determination Theory but also drawing upon research from developmental and environmental psychology, it further proposes a research-informed framework that could be used to enhance nature connection.
Finally, it uses research to make meaningful links between theory and practice, in the pursuit of creating a more meaningful relationship with the non-human natural world.

General Introduction

This narrative thesis carefully and critically examines my already published work. It looks at both the process and the product and focuses on the unique contribution that the work makes to the field. The work was undertaken between 2016 and 2019, although the thinking and experience that led up to the work spans from 2005: the year that I qualified as a teacher in the early years. A body of work was subsequently published in the academic and popular press. Of this greater body of work, five papers are included and critically analysed here.

Throughout this exegesis I present a short introduction to each individual piece, followed by an examination of its originality and significance within the field of education (formal and informal), provide an idea of the intended audience and potential impact of the work and finally address any limitations that arise. The thesis brings together these separate pieces and outlines their inter-connectedness, and impact in the field of education. Moreover, I acknowledge how these pieces come together to provide a bigger picture that is larger than the sum of its parts. Finally, it is crucial to be able to look at the processes and contexts within which these works arose, and the development of my thinking throughout the years of writing, exploring and conducting empirical research on the topic of nature connection.

Context

In 2005 I finished my PGCE at the University of Cambridge and qualified as a primary and early years' teacher. The intense, 10-month programme of study and practice had offered me but a glimpse of what it meant to be a teacher, but I embarked on my new career full of passion and determination to make a difference to the young children I worked with. The next few years saw me teaching in the early years[1]. My experience, as well as my own continuous professional learning, started shaping my understanding of the importance of early childhood for development of various aspects of health, physical and mental. The paramount importance of the quality of relationships at that stage of development, was very much influenced by Bronfenbrenner's Bioecological model of human development (Bronfenbrenner & Morris, 2006). As my understanding grew through my experience, I became interested in the interactions between child and environment – the latter term used in this case as the sum of people, places, settings and conditions that surround an individual. These interactions within the early childhood education setting became central to my interest, and I started exploring within my practice, the effect that a change of environment had on behavioural and affective aspects of children's experience. It was at that time that I became aware of the opportunity that the outdoors offered for children to engage with learning in different ways. As my own outdoor practice emerged, I became more aware of barriers and difficulties in fully engaging with outdoor practice, as well as the benefits of regularly doing so. My first book, co- authored with Dr Jenny Barnett explored some of the effects of being outdoors on children's and adults' subjective wellbeing (Barrable & Barnett, 2016). This was the impetus for further study in the fields of psychology and education.

[1] Throughout this thesis the term 'early years' or 'early childhood' is used to refer to the period between birth and the age of 8 years old. This is in line with the definition given by the World Health Organisation (WHO, n.d.).

Epistemology and Methods

My first contact with educational research following the completion of my undergraduate and postgraduate (PGCE) studies was as a participant in a large scale study on handedness. The school I was employed at had been approached and had agreed to take part in the study, and I was recruited, alongside with several of my pupils. The experience was largely positive and kindled my interest. I got in touch with the researchers, keen to learn more and I ended up first volunteering and then working as a research assistant at the Centre for Psychophysiology and Education, National and Kapodistrian University of Athens. The centre's research work was largely concerned with the neurophysiology and neuropsychology of educational processes, and most, if not all, of the research that took place within it was informed by a positivist epistemology, characterised by strongly quantitative methodologies.

As a practitioner engaged in research it was important for me to engage with the philosophical aspects of it and first observe, and later define, my own epistemological and ontological stance (Bracken, 2010). As such it was clear from the beginning that my assumptions were certainly very strongly underpinned by objectivism. The methodologies I was exposed to were largely quantitative and operationalist in nature. My own research started developing, with small projects relating to teacher education that eventually formed the basis of my Masters by Research in Psychology of Education from the University of York. I relied heavily on operationalisation, the scientific method, and psychometrics. It will be evident to the reader that this tendency remains in the published works contained within this thesis.

However, it was not without criticality that I undertook such investigations and it became obvious to me, as I was exploring questions relating to teachers' experiences and beliefs that there was a greater narrative that was not being captured by the quantitative data alone. With the help of my supervisor at the time, Dr Kathryn Asbury, I expanded my research methods

to include a qualitative element, in a sequential explanatory design (Ivankova, Creswell & Stick, 2006). Mixed methods have been increasingly seen as a paradigm that fits particularly well educational and other social science research (Johnson & Onwuegbuzie, 2004) and I felt that this approach strengthened my confidence in providing a plausible narrative. Furthermore, it provided what Povee and Richards (2015) describe as 'the best of both worlds' (p. 2).

The research presented within this thesis has clear post-positivist influences, with the central premise being one of emphasis on meaning and the creation of new knowledge (Ryan, 2006). Such an approach brings together theory and practice, empirical and theoretical research approaches, and keeps my motivations and former experience firmly in view (Schratz & Walker, 1995). The methodologies employed in the empirical research presented in Barrable & Lakin (2019) and Barrable (2019c) include quantitative and qualitative methods and are an accurate reflection of the mix of methodologies appearing in my other published and ongoing research. The strengths and limitations of each are discussed in the relevant chapter and have been acknowledged within the published articles themselves. The journey has not been a linear one. My own search for epistemological "home" has in some sense come full circle; increasingly, I am drawn to quantitative methods. However, this is not without a new understanding of the nuanced approaches to measurement, especially within the field of psychology. As I delve into the science (and art) of psychometrics, I am increasingly aware of the possibilities and limitations of these methods. What is emerging is an awareness of a mental state, attribute or trait as not being a true object, independent of the individual in question, but instead an emergent or latent property of the individual, inextricably linked to culture, social context and experience. This change has been very much an organic one, mainly influenced by the works of Elina Vessonen (2019) and Denny Borsboom (2005).

Overall, my epistemology now tends towards pluralism in accepting and acknowledging different ways of knowing and exploring the world, while my personal methodological preferences tend towards the quantitative, as well as certain types of mixed methods. Exploratory and explanatory sequential mixed methods that make the most of qualitative and quantitative methodologies within an integrated and

sequential design seem, to me, as ideal methods to capture complexity. Despite the fact that all work I am currently doing relies on such mixed methods designs, the work within my thesis does not. The empirical papers including in this thesis, namely chapters five and six, use purely qualitative and quantitative methodologies respectively. The papers are not chronologically arranged and the quantitative study described in chapter six was the first study that I undertook and designed from scratch, apart from my previous MRes work. For that reason using a quantitative methodology that I felt comfortable with was important to me at that point. The work that is presented in chapter five, on the other hand, which is an ethnographic study of settings around Scotland, was very different for me. It pushed me outwith my comfort zone and my previous epistemological beliefs. I had to engage with different literature in preparing myself to undertake the study, immerse myself in the environments and allow for deep conversation that often felt to have little relation to the topic of my research. The process was a lot more organic at the time, and the analysis of the data challenged me in ways that quantitative analysis never had.

An Overview

Compiling a PhD thesis retrospectively presents a great variety of challenges. In this case, one of these was identifying the 'golden thread', as noted by Smith (2015, p. 91). The 'golden thread' is defined by Smith (2015) as a point of connectivity amongst all the works included in a PhD by publication, or the key theme that weaves through them. Contrary to a traditional PhD thesis comprising a single larger project into which cohesion is woven through a clear plan from the start, a PhD by publication is a collection of published works that one needs to actively weave together *post hoc*.

As a PhD by publication involves a consolidation of related yet different parts, into a coherent whole, it hinges upon a clear articulation of both the *end product* and the *process*. In this section I describe the process, clarifying the connections between each piece of work, as those are situated within time. The product is examined critically in the rest of the thesis (Chapters 1 to 6). Although the thesis is not an exact chronological undertaking, it gives an account of the development of my thinking and describes the deepening understanding that emerged while writing the five papers presented in the following chapters.

My first paper was '**Flourishing in the forest: Looking at forest school through a self- determination theory lens' (Barrable & Arvanitis, 2018; Appendix I, Chapter 1**). The idea for it emerged when, while exploring Self-Determination Theory (SDT) and motivation psychology, as it related to learning, I saw a natural alignment with the aims of forest school, an approach that I had been familiar with from my previous writing and practice (see for example Barrable & Barrable, 2017).

Within this paper, what resonated with me was the relationship between nature relatedness and wellbeing, both as it was already captured in the literature, but with several questions arising that were not fully articulated in previous SDT theorisations or research. This paper is chosen as an introduction to the thesis, as it encompasses a review of the framework that is presented. It also led to me looking more closely at nature relatedness within SDT and within environmental psychology and education as a whole. The terms nature relatedness and nature connection will be explored in **Chapter 2**, an unpublished review of the literature on nature connection.

What followed was the writing of the paper '**The case for nature connectedness as a distinct goal of early childhood education' (Barrable, 2019a; Appendix ii, Chapter 3)** that combined the wealth of research linking nature connection to wellbeing and pro-environmental behaviours, with a look at current early childhood education frameworks from around the world to find areas of meaningful links. The finished paper made the case for the inclusion of nature connection in early years' frameworks, based upon current research. It further highlighted methodological difficulties in this area of research, and offered a vision for future research in this niche.

A natural next step for my work was to bring some of the already existing theory and research together to propose and present a more practical application that could have implications for practice. This led to the writing of **'Refocusing Environmental Education in the Early Years: A brief introduction to a Pedagogy for Connection' (Barrable, 2019b; appendix iii, Chapter 4).** Although focused on early years' practice, the framework presented draws upon research across environmental and developmental psychology and could be applied in a variety of formal and informal educational settings, from early childhood up to and including higher education.

My interests throughout this journey have remained firmly connected to practice. Therefore, the next natural step for me was to observe and dissect current practice, through a view that was informed by both SDT and the newly-emerging focus of nature connection. I have built links with practitioners throughout my research journey, and I was fortunate to be generously invited into several local settings which I contacted. There, I took part in deep conversations on the specific aspect of autonomy within forest nursery practice. This is captured in the ethnographic study **'Shaping space and practice to support autonomy: Lessons from natural settings in Scotland' (Barrable, 2019; Appendix iv, Chapter 5)** which remains dedicated to linking practice with theory in meaningful ways.

As an active practitioner in Initial Teacher Education (ITE), it was important for me to explore the ways that nature connection could be brought into higher education practice, and how it may affect future teachers' willingness to engage in outdoor learning. In an almost circular way, this paper recognises the importance of including nature connection at all levels of education, and especially focusing on influencing the next generation of educators who will go forward to enact practice that will make a difference to children entering its initial stages, in the early childhood and primary stages. **'Nature relatedness in student teachers, perceived competence and willingness to teach outdoors: An empirical study' (Barrable & Lakin, 2019; Appendix v, Chapter 6)** completes a circuit that can effectively bring forward positive change across multiple levels of educational practice, and effect change on the next generation's connection to nature.

The originality of each paper is addressed in each relevant chapter. However, the essence of the originality of this thesis lies in the psychological construct of nature connection, as operationalised and presented in the bridging second chapter, applied within educational settings. Although nature connection is acknowledged as a goal of various approaches, such as the one of forest school (Harris, 2017) it is rarely seen as an operationalised, measurable variable that can be put forward as an outcome of educational programmes. This is closely linked to epistemological (and methodological) assumptions made by different researchers, with most previous research aligning with the interpretivist and constructivist paradigm. This thesis, and my work in general, adds to the methodological pluralism that is needed to holistically

study and explore the complex practice of education. I observe a distinct paradox within education; while a lot of educational *research* is qualitative in nature, and relies on interpretivist paradigms, a lot of educational *assessment* remains grounded in testing using quantitative methodologies. One focus of my work is the application, sometimes for the first time, of quantitative methodologies in educational research within the context of specific settings (e.g. forest schools) and nature connection. This includes work that follows on from this thesis, such as a quantitative cross-sectional study of pre-schoolers' nature connection (Barrable & Booth, 2020). While I acknowledge that this does by no means provide the whole picture, it can illuminate aspects of the practice. Moreover it can create an evidence-base, often called for in policy making and in system change, to support inclusion in mainstream education policy of what has ordinarily been seen as alternative provision (for example, forest schools). Bringing together environmental psychology and developmental psychology to address the needs of learners of all ages to develop an affective, behavioural and cognitive relationship with the non-human natural world my work links research from the area of environmental psychology, which is usually applied to different contexts such as design of built environments, to educational practice in a variety of settings.

Table 1. An overview of the articles included in the thesis

Paper details	Appendix	Chapter
Barrable, A., & Arvanitis, A. (2018). Flourishing in the forest: Looking at forest school through a Self-Determination Theory. *Journal of Outdoor and Environmental Education.* https://doi.org/10.1007/s42322-018-0018-5	(i)	1
Barrable, A., (2019). The case for nature connectedness as a distinct goal of early childhood education, *International Journal of Early Childhood Environmental Education*, *6* (2)	(ii)	3
Barrable, A., (2019). Refocusing environmental education in the early years: A Brief Introduction to a Pedagogy for Connection, *Education Sciences*, *9* (1). https://doi.org/10.3390/educsci9010061	(iii)	4
Barrable, A. (2019). Shaping space and practice to support autonomy: Lessons from natural settings in Scotland, *Learning Environments Research*. https://doi.org/10.1007/s10984-019-09305-x	(iv)	5
Barrable, A., & Lakin, L. (2019). Nature relatedness in student teachers, perceived competence and willingness to teach outdoors: An empirical study, *Journal of Adventure Education and Outdoor Learning* https://doi.org/10.1080/14729679.2019.1609999	(v)	6

The framework

The need for articulation of a unifying framework to enhance the connectivity of a synthesis in the case of a PhD by publication was developed by Trafford and Leshem (2002). They suggest that a clear framework, plainly expressed, can act as scaffolding in the edifice of the thesis. Within the work presented here, SDT has scaffolded my own assumptions, epistemology and methodology, as SDT is an empirically-based theory (Deci & Ryan, 2008) grounded in (post)positivism (DeRobertis & Bland, 2018). SDT provides a lens and a unifying meta-theory of understanding human nature, personality and motivation. The organismic nature of the theory sees humans as active organisms who strive to grow, master their environment and form an idea of a coherent self (Deci & Ryan, 1980) and offers, in my view, a cohesive explanation for both behaviour, and the building of relationship between human and environment.

SDT has a long tradition of being used as a framework for research within environmental sustainability behaviours (see for example Aitken, Pelletier & Baxter, 2016 and Sherman, Bird, Powers, Rowe & Legault, 2016, for self-determined motivation on ecological behaviours); studying the effect of human behaviour on nature (see for example Lavergne & Pelletier, 2015); and the effect of nature on humans (as in Weinstein, Przybylski & Ryan, 2009 and Ryan, Weinstein, Bernstein, Brown, Mistretta & Gagné, 2010). Staying within this tradition of using SDT as a base for exploration of human behaviour, with psychological wellbeing as the ultimate aim, my later work is clearly influenced by SDT but does not stay within the boundaries of social psychology, encompassing broader perspectives from environmental and developmental fields.

SDT is closely examined in Barrable and Arvanitis (2018) and is, in some ways, mapped against forest school practice. Throughout the rest of the work SDT is used more as an underlying framework in its role as a theory of human psychological wellness as well as motivation (Ryan & Deci, 2020). This latter element is particularly relevant when talking about environmental psychology and the motivation behind pro-environmental and ecological behaviours (as discussed, for

example in both Barrable, 2019b and 2019c).

Finally as SDT had not been previously used in the context of forest school and alternative early childhood education before, and only once in the context of teacher education and outdoor learning practice (Barfod, 2018), thereby adds an extra layer of originality to these works. This was a motivating factor in the initial articles presented in the thesis.

To summarise, the role of SDT within my work, as captured in this thesis, but also in my subsequent work, has changed along the process.SDT was initially used as a guiding compass: my initial work (Barrable & Arvanitis, 2018; Barrable, 2019c, Barrable & Lakin, 2019) was very much immersed in SDT and deeply influenced by it. However, as my understanding has evolved, SDT has become more of an underlying theme, with the understanding that the basic psychological need of social relatedness, as described by Ryan and Deci (2017), and nature relatedness, as described by Baxter and Pelletier (2019), have been the focus of my later work (Barrable, 2019a; 2019b) and I have drawn more broadly from environmental and developmental psychology to aid a more holistic approach towards nature connection in childhood and beyond.

The basic principles of SDT, including the idea that our basic psychological needs of autonomy, competence and relatedness need to be nurtured in order for us to flourish as humans, and to achieve wellbeing, still underlines my own thinking and my research. My last article that is included in this paper, chronologically, was a qualitative study on the basic psychological need of autonomy, and how this is supported in nature-based settings. In this sense, SDT is still very much instrumental in my work. Moreover, in the articles where the focus in on nature connection instead, it does so within the context of being a basic psychological need. Finally, I find myself moving towards incorporating other psychological theories alongside SDT in some of my newer work, including for example in an article (Barrable, Touloumakos and Lapere, in press) on motivation and competence for student teachers where we bring together SDT and Bandura’s Self-Efficacy Theory (1977). In other words, I find myself attracted and open to working with a plurality of theories, especially within social and environmental psychology, and often see them as complementary to each other.

CHAPTER 1 - Flourishing in the forest: Looking at forest school through a Self-Determination Theory lens (Barrable & Arvanitis, 2018; Appendix i)

Introduction

Forest school practice has been characterised as under-theorised (Leather, 2018) and although there are many books on the subject of practice in forest schools, most (including Barrable & Barrable, 2017) tend to be descriptive, giving an idea of activities to perform in a forest school setting and focusing on managing risk, rather than offering a foundational philosophy or pedagogical principles behind the actual practice of forest school (e.g. Milchem & Doyle, 2012; Knight, 2011; Worroll & Houghton, 2018). Games, survival skills and bushcraft are at the core of these 'how-to' manuals, which can be very useful for the beginner practitioner.

The expression of this opinion has not gone without protest from the forest school practitioner and research community. Sara Knight, arguably the most prolific writer on forest school practice argues, in a direct response to Leather (2018), that there are several existing theorisations and produces an 'initial drawing together of current theorisations' (2018, p.20).

This initial drawing is rather aptly is a tree, with roots that carry the following words/concepts:
Forest Education; Early Years; Play, freely chosen, intrinsically motivated; Friluftsliv; Outdoor Education;

while the tree trunk has just one phrase on it: Social Constructivist Paradigm.

Finally, the branches and leaves of the tree present the

following constructs / practices / pedagogies:

Pedagogy of Place; Sustainability; Bushcraft; Biophilia; Mindfulness; Pedagogy of Time. (Knight, 2018, p. 20).

While it is useful to have a visual representation of these various theorisations, it is unclear how these very disparate notions, constructs and practices are interconnected. Some of the ideas are very concrete and refer to particular uses of forest school, for example ‘early years’ in the roots. On the other hand, when looking at the leaves and branches, we find two types of pedagogy, which relates to the method and practice of teaching, next to desired outcomes, like Biophilia and Sustainability, and finally Bushcraft, that likely refers to a very practical application and learning of skills. Ideally theory should underpin practice, or work together in synergy (Dewey, 1962; Korthagen, Kessels, Koster, Lagerwerf & Wubbels, 2001). However, in the above visual representation, theory and practice are conflated.

It is important to establish the intended audience for this, or any such, theorisation of forest school. If the practitioner is the intended audience of this theorisation, the visual representation provides no clear guidance for practice. It is rather a heterogeneous mix of constructs, entities, activities, and ideas that give neither guidance nor direction.

Previous work by Leather (2012) has used three theories of constructivism, namely cognitive, radical and social, to situate forest school pedagogy with a focus on the philosophical and sociological aspects of forest school. In Barrable and Arvanitis (2018) we proposed a more psychologically-based framework to support and inform forest school practice. SDT was seen as particularly fitting to forest school, for various reasons explained in the paper.

Originality and Significance

In Barrable and Arvanitis (2018) we put forward a research-informed theorisation of forest school, at the same time as giving concrete ideas for practice. SDT is an empirically based, organismic theory that sees humans as striving for growth. It is largely based in psychology, but its versatility, an effect of its depth and the way it highlights motivational processes, is seen in its many applications in fields as diverse as medicine (Ng et al., 2012), education (Liu, Wang & Ryan, 2015), sport (Hagger & Chatzisarantis, 2007) and law and public policy (Arvanitis and Kalliris, 2017). In highlighting motivational processes, it explains personality growth, and the optimisation of interaction between humans and their environment (Ryan & Deci, 2017).

Although SDT has been used in the past to explore other outdoor education practices, such as outdoor STEM (Science, Technology, Engineering and Mathematics; Dettweiler, Ünlü, Lauterbach, Becker & Gschrey, 2015) and adventure education (Sproule et al., 2013; Wang, Ang, Teo- Koh & Kahlid, 2004) it had not been used in relation to forest school prior to this paper.
Barrable and Arvanitis (2018) is therefore original, and provides a potential theoretical

grounding for this growing practice. The significance of this theorisation lies in the fact that it can guide both research and practice, and that is the aim of the paper. It is constructed in a way that it focuses both on past research in the field of SDT, outlines clear directions for future research, and touches upon aspects of practice. Its relevance to practitioners has been very real, in the author's anecdotal experience when coming into contact with current and trainee practitioners, who have accessed and engaged with the paper. Moreover, it was cited by the fathers of SDT, Ryan and Deci in their latest paper on applications of SDT in education (2020).

Intended Audience and Dissemination

It was our intention right from the start that, although this was an academic paper, it would be accessible to practitioners. Language is therefore simple, yet not simplistic, and arguments are made and presented in a logical way. Moreover, we endeavoured to write for an audience with little prior knowledge of the key concepts of SDT, such as the three basic psychological needs of autonomy, competence and relatedness, and explain these thoroughly throughout.

Throughout, real-life examples were included, and the theory made relevant to the practitioner by clearly laying out how it can be put into practice in a forest setting. As the lead author of the article, I have reached out to the forest school community to further disseminate this work, while drawing more obvious links and opportunities for practice. The peer-reviewed journal chosen for submission, the Journal of Outdoor and Environmental Education, is specialised in the field of outdoor education and gave us access to expert peer-review and editor guidance.

Limitations

SDT is an empirically-based theory. This article is an initial matching between SDT and the practice of forest school. It does not present empirical data, nor does it move beyond making associations between the already well-articulated and empirically-tested theory of SDT and current forest school practice. To move this work forward, empirical investigations should be undertaken. Examples are given within the article itself and one of the recommendations has led to the creation of the research study presented in Chapter 5, as well as another qualitative investigation, currently under way, with two rounds of data collection already undertaken.

In retrospect, another limitation of the article is the lack of focus on the psychological need for relatedness. As my own research interests have evolved in the last few years, relatedness has become central to my conceptualisation of early years' education in nature settings. This is evident in my later work (Barrable,

2019a; 2019b) as well as in some of the empirical work I undertook in relation to teacher education (Barrable & Lakin, 2019; Barrable, Touloumakos & Lapere, under review). An enhanced theoretical framework to inform a more holistic view of practice can be presented after further empirical work has been undertaken. The improved theoretical framework will most likely focus more on the two aspects of relatedness, social and nature relatedness, and draw from the literature reviewed by Baxter and Pelletier (2019 – published after Barrable and Arvanitis). Baxter and Pelletier (2019) use evidence from the general SDT literature to highlight nature relatedness as a basic psychological need, the satisfaction of which leads to flourishing, while its chronic dissatisfaction may explain the disconnect from nature, and even certain behaviours detrimental to the environment. The article in question was not published until after 'Flourishing in the Forest' had already been accepted for publication. Crucially, 'Flourishing in the Forest' presented the same premise of nature relatedness being part of our basic psychological needs and put it at the centre of forest school practice and other outdoor education initiatives (Barrable & Arvanitis, 2018) but stopped short of explicitly connecting the two. Although the connection was not made in the explicit manner that Baxter and Pelletier (2019) articulated, it drew on the same literature. Baxter and Pelletier present a very convincing and cohesive argument that relies on decades of empirical work within SDT.

There are aspects of the flourishing article that would benefit from deeper engagement with the pedagogical aspects of forest school. Through writing this thesis, and engaging more thoroughly with the literature, as well as the practice undertaken in forest schools, my understanding has deepened. There are elements of the paper that no longer reflect how I see forest school practice. However, the key element of providing a framework centred on satisfying children's basic psychological needs remains.

CHAPTER 2 – Nature connection: a review of the literature, constructs and measures

Introduction

Our understanding of nature, and our place within it, can be full of inconsistencies and paradoxes. A qualitative study that explored the conceptualisation of ‘nature’ with western individuals found that, although the majority of participants considered themselves a part of nature, the same participants’ perceptions of nature (as seen in pictures) consisted of landscapes with no human modification present, for example buildings or roads (Vining, Merrick & Price, 2008). Although such a conceptualisation is not universal, it is important to note that separation between human and nature tends to be ingrained in western societies; as opposed to several indigenous cultures, as seen for example in Russell et al. (2013). Being able to conceptualise such a separation, namely between ‘human’ and ‘nature’ may well be beneficial in identifying what we perceive as ‘natural’ (Mausner, 1996). In her research, Mausner qualitatively analysed adults’ perceptions of various environments (in pictures) and found the following five categories of ‘totally natural’, ‘civilized natural’, ‘semi-natural’, ‘quasi-natural’, and finally ‘non-natural’. The above research can provide a useful guide in defining the boundaries between what is considered human versus a natural environment.

The human-nature relationship is often said to reside deep in our evolutionary past (Kahn, 1999) and this is the basis of the Biophilia hypothesis, first proposed by biologist E.O. Wilson (1984). This idea was further explored in Kellert and Wilson’s later book (1995) that theoretically explored our innate affinity to the natural world. Empirically, the hypothesis that we prefer the sort of spaces that were in some way of evolutionary advantage to us was explored and supported by Hinds and Sparks

(2011). In their study adults who were show pictures of various natural environments indicated a preference for coastal landscapes, and landscapes that included fresh bodies of water, like rivers or lakes. Other studies have equally supported the hypothesis of a preference for certain environments based on the evolutionary advantage that they provide, including environments that provide adequate shelter, as well as settings that are more abundant in food and fresh water (Kellert & Wilson, 1993; Windhager, Atzwanger, Bookstein & Schaefer, 2010). Despite our move into urban environments, our close relationship to nature has indeed persisted (Nisbet, Zelenski & Murphy, 2011This human-nature relationship theory, with its roots in our evolutionary past does not exist without criticism. Joye and De Block (2011) present convincing criticism of the Biophilia hypothesis, focusing on the variety of interpretations that surround the various constructs around Biophilia, as well as a close scrutiny of the empirical findings that have in the past been used to support the hypothesis, but which could be open to alternative explanations.

Looking more broadly, and away from western-centric thought, Traditional Ecological Knowledge (TKE), namely the knowledge from indigenous people whose relationship to the natural world has been more inextricable and whose survival across the centuries depended a lot more directly on this relationship, has come in to complement other approaches (e.g. Pecl et al., 2017). It brings a more holistic view of the ecosystem, with humans as one part of it. It has also influenced educational theory and practice in countries such as Australia (Brady, 1997; Hart Hart, Whatman, McLaughlin and Sharma-Brymer, 2012) and Canada (Ball, 2004; Battiste, 2009), where indigenous knowledge presents an opportunity to explore social and environmental relationships more broadly and holistically.

Within Western traditions there has often been a dichotomy of human and nature, perhaps influenced by Aristotelian thinking, as well as Parmenides, Thales and other Greek thinkers, (Carone, 2011), and Abrahamic religions, for example how the Bible distinguishes between man and beast (Eccles. 12:7; 1 Thess. 5:23). In direct contrast many indigenous cultures see a great interconnection and inseparability of human and non-human nature (Kingsley, Townsend, M., Henderson-Wilson, 2013). The merit of alternative points of view and traditions is acknowledged, but given my own background and the context in which this thesis was written, as well as the psychological literature it draws upon, I will focus on a

western perspective henceforth.

Regardless of the traditions that inform our knowledge, the evolutionary antecedents of nature connection, and the theories or hypotheses that aim to explain its use in human adaptation across the evolutionary process, nature connection, in this thesis, is defined as the latent construct that describes our emotional affiliation with or 'sense of belonging to' the natural world (Mayer, Frantz, Bruehlman-Senecal & Dolliver, 2009; p 610). This connection is associated with a number of positive outcomes, which will be examined in a later section of this chapter.

Constructs and measures

In order to study the human-nature relationship various constructs have been articulated within the field of environmental psychology. Moreover, different instruments have been put forward and validated for measurement of these subjective constructs. This section will describe them and identify some of their differences, highlight points of interconnection, as well as identify a term that will be used throughout this thesis.

Measures and constructs of nature connection outlined below were identified through internet keywords searches using Scopus, Web of Science, ERIC and Google Scholar. The search was undertaken between November 2017 and January 2018. The following keywords were used: "nature connect*", "nature relatedness", "relationship to nature" and "human-nature relationship". Moreover, once initial scales were identified, a backwards and forwards snowballing approach was used. Snowballing is seen as a very useful tool in identifying literature, especially in instances of complex constructs such as the nature connection in this instance (Greenhalgh & Peacock, 2005). Tam's work (2013) was used as a useful starting point for forwards and backwards snowballing.

Tam has mapped out the concepts and measures of nature connection and I started my own literature search from his work. Moreover, I will be using his table as a useful way to outline the various concepts and measure. In Table 2 the original concepts as outlined by Tam (2013) will be marked by an asterisk, while new additions found in the literature by me will be unmarked. All but three of the scales

in Table 2 were created and validated for measuring implicit or explicit connection in adult samples, with several of them having been validated for use with children aged 8 upwards. The three scales developed for use with children are in italics. All but one (Sobko, Jia & Brown, 2018) are self-report measures, with the latter being a parental-report measure.

Table 2. Concepts and measures of nature connection (adapted from Tam, 2013)

Concepts/Measure/Author	**Brief description of measure**	**Brief description of construct**	**Reliability**
*Commitment to the Natural Environment Scale (CNE; Davis, Green & Reed, 2008)	Self-report 11 items, 9-point Likert scale	Similar to measures of inter-personal commitment, it conceptualises the person-nature relationship as mirroring a person-person relationship.	α = .87 (Davis, Green & Reed, 2008)
*Connectedness to nature scale (CNS; Mayer & Frantz, 2004)	Self-report 13 items (trait) or 14 items (state), 5-point Likert scale	Humanity as a whole being a part of the natural world.	α = .79, reported in Mayer & Frantz, (2004).
*Connectivity with nature (CWN; Dutcher, Finley, Luloff & Johnson, 2007)	Self-report Four items on a 5-point Likert scale, fifth item is 3 Venn diagrams of self and nature.	Bi-directional measure of relationship of person with nature and nature with person.	α =.72 reported in Tam (2013)

*Emotional affinity toward nature (EAN; Kals et al., 1999)	Self-report 16 items, 4 sub-scales, 6-point Likert scale	Connection is seen as an emotional bond, rather than a cognitive process.	α = .80, reported in Kals, Schumacher & Montada, (1999)
*Environmental identity (EID; Clayton, 2003)	Self-report 24 statements (long form), 11 statements (short form). Initially designed as a one dimensional instrument (Clayton, 2003), 5 sub-scales have since been identified (Clayton, 2012).	The natural environment is seen as an important part of the individual's self-concept.	α = .90, reported in Clayton (2003)

Concepts/Measure/Author	**Brief description of measure**	**Brief description of construct**	**Reliability**
*Inclusion of Nature in Self (INS; Schultz, 2001)	Self-report Seven variously overlapping Venn diagrams of Self and Nature	Nature as part of the individual's conceptualisation of the self (explicit).	Convergent validity (Tam, 2013)
*Nature Relatedness (NR; Nisbet et al., 2009)	Self-report 21 statements (long form), 6 statement (short form), 5-point Likert	Influenced by deep-ecology, it measures biophilic tendencies (including behavioural aspects).	$\alpha = .87$, reported in Nisbet et al., (2009)
Implicit Association with Nature Test (IAT; Schultz, Shriver, Tabanico & Khazian, 2004)	Implicit measure. Words (e.g. animal, tree) have to be assigned to a category of 'nature', 'me', 'not me' or 'built'.	Nature as part of the individual's conceptualisation of self (implicit).	Pre-post test internal consistency $r = .41$, $p < .001$ reported in Bruni, Ballew, Winter & Omoto (2018)
Disposition to Connect with Nature Scale (DCN; Brugger, Kaiser & Roczen, 2011)	Self-report 5 items.	Two major components are connection to and care towards nature.	$\alpha = .94$ reported in Brugger, Kaiser & Roczen (2011)

Love and Care for Nature Scale (LCN; Perkins, 2010)	Self-report 15 items, 7-point Likert scale	An inherent love for nature leads to the desire to care for it.	α = .97 reported in Perkins, (2010)
Connectedness to the Natural Environment Scale (CNES; Sparks, Hinds, Curnock & Pavey, 2014)	Self-report, 7-point Likert scale	Encompasses both affective and cognitive aspects of connection. It further captures pro-environmental attitudes.	α = .94 reported in Sparks et al., (2014)

Concepts/Measure/Author	Brief description of measure	Brief description of construct	Reliability
Connection to Nature Index for Parents of Preschool Children (CNI-PPC; Sobko, Jia & Brown, 2018)	*Parental report* *16 items, 5-point Likert scale*	*Four dimensions, comprising of enjoyment and awareness of nature, and empathy and responsibility towards nature.*	*α > .80 (Sobko et al., 2018)*
Children's Affective Attitude to Nature Scale (CAN; Cheng & Monroe, 2012)	*Self-report (9-11 year olds)* *22 items, 5-point Likert scale*	*It encompasses empathy for Non-human, sense of responsibility towards nature, a sense of one-ness with the natural world and enjoyment of nature.*	*α = .87 (Cheng & Monroe, 2012)*
NCI (Richardson et al., 2019)	*Self-report (7+ years of age)* *6 items, 7-point Likert scale*	*Each item focuses on one of the following: beauty, emotion (happiness, awe and wonder), contact and meaning, compassion, and connectedness/being part of nature.*	*α = 0.92 (Richardson et al., 2019)*

*Measures included in Tam (2013)

Given the various concepts and measures outlined in Table 2, it is reasonable to try and define first the terms, and then the scope of the terms that will be used in this thesis. ‘Nature connection’ will be the preferred term for this thesis, and the following working definition will be used as encompassing the key characteristics, the common ground, of the constructs outlined above. For the purpose of this thesis nature connection is a subjective emotional attachment to the natural world (Mayer & Frantz, 2004; Nisbet & Zelenski, 2013) that includes positive affective responses to nature , and a ‘one-ness’ or feeling a part of the natural world (Schultz, 2001; Schultz, Shriver, Tabanico & Khazian, 2004). In general the term ‘nature connection’ is often used as an umbrella term for several related constructs that encompass various aspects of the human-nature relationship, as noted above.

It should further be noted, however, that in the published articles included in this thesis different terms are used, notably, ‘nature relatedness’ in Barrable & Arvanitis (2018) and Barrable & Lakin (2019), ‘nature connectedness’ in Barrable (2019a; 2019b) and interchangeably ‘nature connection’ and ‘connection to nature’ for Barrable et al. (under review). This is primarily due to subtle differences within the constructs that are employed in each case, but also due to the use of particular instruments’ fitness for purpose, e.g. the NR looks at experiential aspects of nature, which suited the type of use for the Barrable and Lakin (2019) paper, while Barrable et al. (under review) used nature connection as it described a broader, more inclusive term as described by the participants in the study.

There is a marked advantage in using the broader, more general term of ‘nature connection’ to describe the positive human-nature relationship. Some of these relate to facilitation of broader literature searches, but the main advantage is an intuitive understanding by most people of the term ‘nature connection’ as one that describes a human’s association to nature and the natural world. The term is often used in everyday speech and non-specialist writing (see for example Crockett, 2014 for the popular press outlet Huffington Post) and I believe it is a term widely understood. As one of my aims as an academic is to make my own work accessible to non-academic audiences, the use of the term ‘nature connection’ is thus advantageous is facilitating access of this content by a more

diverse audience.

Nature connection associations

This section aims to present a succinct picture of the last two decades of study on nature connection and the positive associations it has been found to have. Two limitations of the studies presented in this section need to be highlighted at the beginning. The first one relates to the methodologies employed in all of the studies presented, which are cross-sectional across the board. Therefore, the results presented are purely correlational, and in no way give us information on the causal direction of association. The second is a limitation of the research to date, which focuses overwhelmingly on adult participants.
Therefore, although we can make assumptions that these associations hold true for children as well, the evidence for the strength of these correlations in younger people is much smaller and presented at the end (two published studies and an unpublished thesis). The author's own research aims to focus more heavily on these relationships in children, with two research projects in preparation that aim to explore nature connection in preschool and school children respectively (explored more closely in the conclusion section of this thesis that looks at current and future work).

A lot of the associations between nature connection and wellbeing are discussed in length in Barrable (2019b) and touched upon in Barrable (2019a). To summarise, most of the research shows positive associations between nature connection and desirable outcomes such as greater acceptance of self (Howell, Dopko, Passmore & Buro, 2011), greater vitality (Mayer et al., 2009), general wellbeing and happiness (Howell et al., 2011; Capaldi et al., 2014), positive affect (Capaldi et al., 2014) and eudaimonic wellbeing (Pritchard, Richardson, Sheffield & McEwan, 2019). In a large meta-analysis of over 30 studies, nature connection was found to have the same size effect in relation to wellbeing (r=.24) as other desirable variables, such as level of education and income (Capaldi et al., 2014).

Besides wellbeing, nature connection has been consistently found to be associated with ecological attitudes and behaviours (Frantz & Mayer, 2014; Mayer & Frantz,

2004; Nisbet, Zelenski & Murphy, 2009). Moreover, this relationship with nature that affects our later ecological identity seems to have its roots in childhood (Rosa, Profice, & Collado, 2018; Wells & Lekies, 2006).

There are methodological limitations to these studies. Firstly, they are mostly observational, with very little experimental data collected in this field. We can therefore not be certain of the direction of causality between the two variables of nature connection and wellbeing, or even if there does not exist a third common causal variable for them both.

The second methodological limitation is again to do with the type of research that has been undertaken. Most research to date has focused on adults (young adults, often students). This is not uncommon in psychology, and it is commonly known as the WEIRD problem, where there is an over-representation of Western, Educated, Industrialised, Rich and Democratic participants (Henrich, Heine, & Norenzayan, 2010). The Henrich et al. (2010) study looked at psychological science in the last century and found that 80% of studies used WEIRD samples. In contrast, only 12% of the world population fits into that category, and there is reason to believe that when it comes to cognitive, affective and other aspects studied in psychology, there can be variation depending on cultural, socio-economic or other backgrounds.

Studies that have looked at associations of nature connection in childhood are fewer, but notably they seems to support the associations observed in adults. A large scale study of 775 English children (aged 10-11) found that there is a ‘threshold’ of nature connection beyond which children were found to have higher life satisfaction, as well as pro-environmental attitudes and behaviours (Richardson, Sheffield, Harvey & Petronzi, 2016). A strong correlation was found between nature connection and pro- environmental attitudes ($r = .59$, $p < .01$) and behaviours ($r = .60$, $p < .01$). These numbers are even higher than the ones reported in adults (Mayer & Frantz, 2004; Nisbet, Zelenski & Murphy, 2009). Moreover, Otto and Pensini (2017) in a study of children in similar ages found that nature connection explained most of the variance in ecological behaviour (69%). Environmental knowledge on the other hand only explained 2%.

Up until 2018 there had been no studies of nature connection in early childhood using quantitative methodologies, although nature connection as a general concept, rather

than an operationalised construct had been used often in literature and the call of reconnecting young children to nature was made often (Louv, 2008; Zylstra, Knight, Esler, & Le Grange, 2014). This was largely because until then there was no validated measure that could be used to measure nature connection in children younger than 8 years of age. In 2018 Sobko et al. adapted one of the instruments used for older children (Cheng & Monroe, 2012) for use with the parents of preschool children. This parental-report, 16 item, 5 Likert response scale instrument was tested in a population of 493 children in Hong Kong for internal consistency and external validity. Furthermore, it was then tested against the Strengths and Difficulties Questionnaire (SDQ; Goodman, 2001). Several associations were reported by the authors, both with the general scale, as well as the four domains that make up the sub-scales. Namely, nature connection in pre-schoolers was positively associated with increased psychological functioning. Awareness of Nature, one of the subscales, was found to negatively correlate with behavioural problems (r=-.64). Moreover, Responsibility towards Nature was positively associated with prosocial behaviours (r=.77), and negatively associated with conduct problems (r=-62), peer problems (r=-.65) and hyperactivity (r=.-50). This scale was used in Barrable and Booth (2020) to compare a population of UK pre-schoolers that attend nature nurseries with those that attend traditional settings. Results indicated a significant difference between the two groups.

An important limitation of the Sobko et al. (2018) scale is that it relies on parental report. Previous studies that have looked at comparisons between self-reporting and parental-reporting (see for example Manne, Jacobsen & Redd, 1992), have indicated that parental reports tend to reflect the subjective perception of the parent to the child. Moreover, other studies have presented low consistency between parental-proxy and self (child) report (Senner & Fish, 2012), while the parent's own experience has been found to impact the proxy-report on their child (Cremeens, Eiser & Blades, 2006). We should, therefore, be cautious in the interpretation of the data, and work towards ways of capturing the child's own subjective description of their relationship to nature. This will be explored more deeply in the final chapter of this thesis.

CHAPTER 3 – The Case for Nature Connectedness as a Distinct Goal of Early Childhood Education (Barrable, 2019a; Appendix ii)

Introduction

This Chapter looks critically at Barrable (2019a) which is a conceptual paper focusing on two key themes. In the first instance, the current goals of early childhood education, as those articulated in various international frameworks and curricula were identified. The process is described below. I wanted to use a framework that was both research-based, but also value driven. For that reason, three aspects of the psychology literature were reviewed in the process of justifying the need for nature connection to be identified as a goal for early childhood. This process will also be described in detail, critically looking at methodological and epistemological choices made by the author throughout the process.

Initially, a review of the grey literature on the underlying aims of early childhood education was undertaken. The rationale was to capture policy as written in government documents and curricular frameworks. The language of the review was English, and therefore only curricular framework from English speaking countries were sought. These included evidence from Australia (Australian Government, 2009), Ireland (CECDE, 2006), Scotland (Scottish Government, 2008), England (DFE, 2017) and two provinces of Canada (Makovichuk, Hewes, Lirette & Thomas, 2014; Nova Scotia, 2018). The search was not systematic, but instead focused on exemplary curricula that placed children's wellbeing at the centre. The review was purposefully looking for evidence that wellbeing has been in the past identified as a worthwhile goal of early childhood education, and how that goal was facilitated through relationships with caregivers, as well as other adults and children. Moreover, the author also looked for evidence that the following were identified as important outcomes of good quality early childhood education: pro-environmental attitudes and

a relationship with the natural environment, goals that related to Education for Sustainable Development (ESD), especially as those related to environmental sustainability, and finally, Environmental Education (EE) in, about and for the environmentDuring this research of the literature it became apparent that early years' education has changed in a substantial way in the last few decades (Moss, 2014). In the last fifteen years new curricular frameworks have emerged in a number of western countries, such as Australia, Ireland, England and Wales, and Scotland (Australian Government, 2009; CECDE, 2006; DFE, 2017; Scottish Government, 2008). These frameworks have tended to be child-centred and have largely aimed at being research-informed and developmentally aligned to the needs of young children (Walsh, Sproule, McGuinness, Trew, & Ingram, 2010; Whitebread et al., 2011).

Identifying the elements of ESD, EE and wellbeing in several of these curricular frameworks helped the author support the argument that nature connectedness, as a distinct goal, brought together several of these desirable outcomes. Current evidence from environmental psychology was used to highlight the associations between nature connectedness and several types of wellbeing (Capaldi, Dopko & Zelenski, 2014; Howell, et al., 2011; Trigwell, Francis & Bagot, 2014).

The visual that was produced and presented in Figure 1 of Barrable (2019a) had initially been used by me as a planning tool. However, as it aimed to show the alignment of early childhood goals as those are identified in the various curricular frameworks, on the one hand, and nature connectedness correlates, as those are identified in recent environmental psychology literature I felt that it would be useful to the reader to include it in the paper. The visual both helped to clarify my own thinking on the subject, but also guided the structure of the paper itself in the end, in an effort to make it readable, clear and succinct.

Originality and Significance

This article presents a novel conceptualisation of the role of nature connectedness, a largely psychological construct, as a desired and worthwhile goal of early childhood education. In the past, connection to nature has been identified as a useful tool to be used in the assessment of environmental education programmes in secondary education (Frantz & Mayer,

2014).Furthermore, it is implicitly identified as a desired outcome of various environmental education programmes, again in formal primary, secondary and tertiary education (Kossack & Bogner, 2012; Liefländer, Fröhlich, Bogner & Schultz, 2013; Mullenbach, Andrejewski & Mowen, 2018), as well as in informal outdoor activities, such as summer camps (Collado, Staats & Corraliza, 2013; San Jose & Nelson, 2017). Finally, it is identified as a goal in alternative forms of education, such as forest school (FSA, n.d.), though not explicitly so, and it was articulated as such by Barrable & Arvanitis (2018).

However, no explicit connection had been made between nature connectedness and early childhood education goals in the past. The Australian curricular framework for early childhood makes implicit suggestions, as some of its goals echo what is at the heart of nature connection, with outcomes such as "*children are connected with and contribute to their world*" (Australian Government, 2009, p. 28) and "*children become socially responsible and show respect for the environment*" (Australian Government, p. 32).

The article in question (Barrable, 2019a) is the first of its kind to put forward nature connection as an explicit goal of early childhood education, unique, but interrelated to other goals, such as wellbeing and action for sustainability. The originality of the article was further commented on by the two reviewers who peer-reviewed the article before publication.

Intended Audience and Dissemination

This article was largely written with three audiences in mind. As with most research articles, one of the intended audiences was other academics and researchers in the area of early childhood education, especially early childhood environmental education. It was for this reason that the International Journal of Early Childhood Environmental Education (IJECEE) was chosen as a suitable outlet. The journal, now in its sixth year, is the official journal of the North American Association for Environmental Education (NAAEE). It is a peer-reviewed and open access journal that aims to address policy, practice and research. As this article addressed exactly

these three broad areas, and the link between them, it was judged to be a suitable outlet. Moreover, as the intended audiences spanned across these three areas dissemination through this medium was seen as a great way to reach them. Finally, the two broad visions of the journal, as expressed in its scope are:

> *"(a) To encourage thoughtful sharing of information about important ideas, conceptualizations, and frameworks, as well as effective practices and policies in early childhood environmental education; and*
>
> *(b) To reach an extensive global readership in order to maximize the impact of the thoughtful information."* (NAAE, 2013)

Both of these goals perfectly aligned with the goals of this particular article.

Limitations

The paper does not come without its limitations. These can be identified as both methodological, as well as relating to the limitations of the evidence used. In terms of methodology, and relating to the review of the grey literature, the author had to limit herself to policy and curricular frameworks that were written in English, and were accessible through the internet. This, of course, gives a limited scope to the review, as well as a narrow picture of what may be globally recognised and identified as a goal or desired outcome in countries other than the ones the author was able to access.

Moreover, the searches were not systematic, and the author relied mostly on commercial search engines (e.g. Google, Ecosia) to locate government guidance on early childhood education. This type of sampling can, of course, provide a skewed picture of the current state of early childhood education across the world. However, it was not the intention of the author to provide an exhaustive review of curricular frameworks, but rather to identify good practice and research-informed curricula that could be used as an example of progressive and current thinking in the field.

Finally, the author does acknowledge in the article the limitations of the research used to make the case for nature connectedness. At the heart of that, is the dearth of studies that look at nature connectedness within an early years' context. This is despite the fact that a lot of education in the early years is perfectly placed to deliver such an outcome. A key reason for this lack of investigations into early childhood nature

connectedness (apart from retrospective studies, e.g. Wells & Lekies, 2006) was identified by the author as the lack of a validated instrument that currently exists to measure child-report of nature connection under the age of eight. One of my current research projects aims to address this, and is explored in the Conclusion section of this thesis.

CHAPTER 4- Refocusing environmental education in the early years: A brief introduction to a pedagogy for connection (Barrable, 2019b; Appendix iii)

Introduction

The article, published in a special issue on Ecocentric Education, initially recognises some of the changes that have taken place in both the terminology that refers to sustainability education, as well as in the meaning that is assigned to these terms. The move from environmental education (EE) towards Education for Sustainability (ESD) is briefly examined. This move is seen as marking a shift in attitudes, from an education that is very ecocentric, or as Julie Davis (1998) described it, *in*, *for* and *about* the environment, to an education that largely promoted anthropocentric goals, within a sustainable framework. The article is not the first to note this shift, or make the distinction. Previous research work has noted this move, alongside the dangers that the change has caused (Kopnina, 2012). Kopnina (2012) presents a clear point on the move away from environmental ethics, and describes the processes by which dominant political ideologies as well as corporate interests can overshadow concern for the environment. She further elucidates this point by juxtaposing anthropocentric and ecocentric goals in education.

Barrable (2019b) uses this distinction to suggest that the balance needs to be redressed, through the presentation of an ecocentric model of education. Moreover, it suggests that EE should be refocused, back to its original definition of *in, for* and *about* the environment (Davis, 1998). Using that definition, Davis herself several years later (2009) identifies a 'hole' in the models used at that time when considering early childhood education for sustainability. This 'hole' or the missing element that exists both in the theory and practice of early childhood education for sustainability as identified through the means of a literature review by Davis, pertain to the element of 'for' the environment. This will be explored further, in the

context of how Barrable (2019b) attempts to bring together research-informed guidance that addresses the ‘for’ element.

The article is very much contextualised within another shift, this time relating to early childhood education *in* the environment. Alternative settings for early childhood provision have become more common across much of Europe, the US and other locations around the world. The paper gives an account of forest schools and forest kindergartens, nature preschools and other outdoor provision in natural spaces and their increasing popularity. It presents a recent study from the US and recognises that while such provision has been observed in much of Western Europe, in countries such as Germany, Denmark and Sweden for much of the late 20th century, the 21st century has seen continued growth in those countries and a substantial move towards such provisions in other countries. The article provides a clear overview of this growth, while it also attempts to offer some contextualisation of the rise in such provision. Moreover, it looks critically at the growth of outdoor pedagogies that can offer effective and evidence-based frameworks to support and guide practice. Indeed, although some pedagogical frameworks have emerged to fill this space, such as that of forest school (udeskole) at it is articulated in the Scandinavian countries (Barfod & Mygind, 2018; Williams-Siegfredsen, 2017), or the UK iteration of Forest School (Knight, 2011), the pedagogical intricacies behind such approaches have been characterised by academics as under-theorised (Leather, 2018). Despite this observed gap in theory, forest schools have grown and thrived in the UK, with more than 120 in early 2019 being recorded (FSA, n.d.), with other nature settings also seeing considerable growth. In the context of Scotland in particular the first fully open air forest opened in 2008 in Fife (Care Inspectorate, 2018). By November 2018, nineteen early learning and childcare settings across the whole of Scotland had moved into forest locations, with a lot more incorporating some aspect of regular outdoor learning in their programmes (Care Inspectorate, 2018).

This move towards alternative early childhood education settings coincided with, or is perhaps directly influenced by, several voices from both sides of the Atlantic calling for children to (re)connect with nature (Chawla, 1999; Louv, 2008; Walden, 2007). This call has largely been driven by two trends. On the one hand, mounting evidence is suggesting that natural environments were beneficial for children’s mental and physical development and health (Chawla, 2015; Grinde & Patil, 2009;

Hartig, Evans, Jamner, Davis & Gärling, 2003; Van den Berg, Hartig & Staats, 2007). On the other, environmental

destruction and climate change were starting to emerge as global and urgent issues for this and the next generation.

In 2011, the EU set up an independent research group, the European Panel on Sustainable Development (EPSD) mostly consisting of academics from several universities across Europe, including the Universities of Gothenburg and Lund, from Sweden (University of Gothenberg, 2011). The group was invited to compile and submit a report on early childhood education and sustainable development. The recommendations from the group to the EU were clear. One key recommendation was that the EU (and its constituent nations) should aim to integrate, as well as produce, framework programmes that would integrate ESD and early childhood education. Moreover, the group also recommended the inclusion of ESD and early childhood education in all Initial Teacher Education (ITE) programmes, as well as continuing professional development and in-service training for teachers. Barrable (2019a, 2019b) argue for the first point, and present such a framework, while Barrable & Lakin (2019), as well as Barrable, Touloumakos & Lapere (in press) make suggestions for the second point.

Originality and Significance

Even given the gap in knowledge, and one would argue practice too, described above, few such frameworks emerged, and the curricula and policies that developed during this time lack explicit mention of the need for an early childhood education *in*, *about* and *for* the environment. Certainly, the move towards more forest schools, outdoor kindergartens and other learning in natural settings fulfilled the first of the three features, while knowledge-rich curricula in the natural sciences and geography met the need for an education *about* the environment. But as is highlighted by Julie Davis in her review of the literature "Hardly any centred on young children as agents of change (education for the environment)" (Davis, 2009, p. 227).

Nature connectedness is proposed in this model as the glue that can bring together these three elements put forward by Davis, highlighting the role of children as

pro-environmental champions. This hinges upon the evidence coming from the environmental psychology literature that has found an association between connection to nature and pro-environmental attitudes and behaviours (Andrejewski, Mowen & Kerstetter, 2011; Nisbet, Zelenski, & Murphy, 2009; Pereira & Foster, 2015; Restall & Conrad, 2015).

Furthermore, a close emotional connection to the natural world can predict ecological behaviour in children (Otto & Pensini, 2017). More specifically, Otto and Pensini looked at the effect of a nature- based EE programme in 255 children aged 9-11. The results showed that, although participation in the programme was associated with a rise in ecological behaviours, 69% of the variance was explained by connectedness to nature, while only 2% was explained by increases in environmental knowledge.

Although both of these are desired outcomes, it seems that focusing on nature connection as a desired outcome of nature-based EE programmes may be more effective in preparing children to be the "agents of change" that Davis (2009, p.227) has identified as missing from current programmes.

Barrable (2019b) also identified early childhood as suitable time to introduce such educational programmes. This hinges upon three arguments that are examined in the article. Firstly, that education in natural spaces already popular and secondly on the evidence from environmental psychology suggesting childhood is a key time for the development of a relationship with nature (Wells & Lekies, 2006; Otto & Pensini, 2017). Finally, evidence from developmental psychology to suggest that early childhood is a key time for the development of emotional skills, like empathy.

The brief introduction to this framework is original, in that it synthesises already existing evidence from different disciplines, to suggest a way in which the 'hole' in practice and research identified by Davis (2009) can be addressed. Moreover, it offers a research-informed basis upon which to build a more elaborate pedagogical framework for early years' nature-based environmental education with the aim of promoting both children's wellbeing, as well as ecological and pro-environmental behaviours.

Intended Audience and Dissemination

This paper was written in response to a call for papers for a Special Issue of Educational Sciences, titled Ecocentric Education. The special issue was guest edited by Dr Helen Kopnina, an expert on ecocentric approaches, and focused on ecological values in an EE and ESD context. The manuscript initially received three reviews, two of which were positive and constructive and one which was not. Two further reviewers were invited. The manuscript went through 3 rounds of reviews in all, before the final version was accepted. Two of the reviewers commented on the exciting implications for practice, and one of them noted that she would recommend the article to her students in teacher education. This aligns with who I see as the intended audience. Teacher education and practitioner professional learning would be the perfect outlet for this theoretical work. To this effect, I wrote an article for Teach Early Years Magazine, a professional publication with an audience of about 49,000 early years' professionals (Stow, personal communication, October 18th 2019) in September 2019.

Limitations

The biggest limitation is that the article does not present a fully articulated framework, nor does it claim to. This article offers some initial guidelines for developing a framework for early childhood environmental education, the basis of which is identified as increasing nature connectedness.

In retrospect, there are further elements that could be added to the framework, especially if that were to be explored more closely through a SDT lens. Greater emphasis on the two aspects of autonomy and competence would, under such a lens, be seen to increase motivation. The mediational role of self- determination in pro-environmental behaviours has been examined by a study in Canada (Pelletier, Dion, Tuson & Green-Demers, 1999). The study found that self-determined (i.e. autonomous) motivation mediated the relationship between concern and competence, and actual pro-environmental behaviour.

Earlier research had only proposed a link between knowledge of the problem (i.e. the severity of the environmental catastrophe) and a perception of competence for taking action (Pelletier, Green-Demers & Béland, 1997). Interestingly, the previous study did not look at the role of relatedness.

A very recent study, however, argues for nature relatedness as a basic psychological need (Baxter & Pelletier, 2019). A critical review of the evidence to date by the two authors, suggests that nature relatedness is both need-as-requirement, as well as need-as-motive, with the former being supported by more of the research examined. In that sense, a self-determination model for pro-environmental behaviours could certainly make space for nature relatedness as motive. Moreover, seeing as the three basic psychological needs of autonomy, competence and relatedness often work in synergistic ways (Ryan & Moller, 2016).

Despite its limitations, the strongest and most important part of the article is not the development of that idea, but the chance to examine the existing evidence, identify research gaps and offer a clear research direction in the field of nature connectedness, childhood and education. Moreover, the focus on nature connection, and the use of current experimental evidence to produce a framework can be seen as timely. Consistent with one of the reviewers' comments, this article could form a basis of early childhood teacher education programmes.

CHAPTER 5 - Shaping space and practice to support autonomy: Lessons from natural settings in Scotland (Barrable, 2019c; appendix iv)

Introduction

An aspect of enhancing nature connection that was not highlighted in the framework presented in Chapter 4 was the one of autonomy. The connection was one initially made in Barrable and Arvanitis (2018; Chapter 1) but was not articulated in Barrable (2019b; Chapter 4). This was partly due to a different focus of the article, on environmental and developmental psychology research and empirical evidence, rather than theory based assumptions. Another reason was that the article that made the explicit link between nature relatedness and the other two psychological needs, namely that of Baxter and Pelletier (2019) had not yet been published.

As briefly discussed in the previous Chapter, looking at the three basic psychological needs as working in a synergistic and cumulative way makes the argument that by supporting one need we are nurturing the others (Ryan & Moller, 2016). The research on autonomy support in primary-aged and older children, within educational as well as parenting contexts is briefly described in Barrable and Arvanitis (2018).

However, the literature on autonomy support with younger children in a learning context is only just emerging, with only one qualitative paper exploring and reporting on it (Côté-Lecaldare, Joussemet & Dufour, 2016) while another article reports on parental experiences (Andreadakis, Joussemet & Mageau, 2018). This paper emerged rather organically as part of a larger project entitled ‘Autonomy Support in the Forest’. The whole project focused on practitioners understanding of the term autonomy, the manifestations of autonomy in their nature nursery practice, and the inter-play between autonomy and structure. The latter has been identified as a key component of autonomy-supportive practices in several previous research studies with older children (Reeve & Jang, 2006; Sierens, Vansteenkiste, Goossens,

Soenens & Dochy, 2009). The initial project was designed around several questionnaires and practitioner focus groups. However, as the process of engaging with practitioners progressed, I found myself immersed in the world of the practitioner and deeply curious about the enactment of practice. I felt the need for a research design that not only looked at practitioner perceptions, but attempted to capture some of the practice itself. Barrable (2019c) presents the results of an ethnographic exploration undertaken in nature kindergarten settings in Scotland.

The paper (Appendix iv) delves into the world of the nature kindergarten in six settings within Scotland and explores autonomy support from a Learning Environments perspective. As such, it initially situates itself in relation to previous Learning Environments research literature, identifying various previous publications that relate to the topic, and continues by expanding upon it.

This empirical study is inspired by the theoretical work presented in Barrable and Arvanitis (2018) and uses the framework articulated in that to empirically explore practical and real-world manifestations of the autonomy supportive practices. Furthermore, it builds on the idea of affordances as this was explored previously.

Originality and Significance

The study is novel on the following grounds: For one it is unique in the literature that explores autonomy support in the early years. Although it follows on from recent studies that explore autonomy support in early childhood (e.g. Andreadakis et al., 2018; Côté-Lecaldare et al., 2016) it employs a different methodology. Through ethnography, rather than interviews and questionnaires, it aims to capture complex relationships and aims to particularly focus on the interactions between child – adult – (natural) environment. Moreover, it attempts to untangle the interactions observed and describe the role of the practitioner in facilitating meaningful connections between child and environment.

Secondly, the research study was situated within previous Learning Environments work, something novel for nature schools. Learning Environments research studies the effect that the physical and social environment can have on student and learning

outcomes. However, a very small subsample of Learning Environments research has focused on outdoor spaces (see for example Dahl, Sethre-Hofstad & Salomon, 2013 in relation to summer camps, and Nedovic & Morrisey, 2013), and none have looked at nature schools before. In this sense this current ethnographic study is novel in conception. Furthermore, it offers a significant contribution to further strengthening the links between research and practice in nature-based settings, as it is written with the practitioner in mind, offering ways to emulate good, research-informed practice.

Intended Audience and Dissemination

This article was very much conceptualised as a bridge between research and practice: a way for me as a researcher to capture excellent practice that is already happening and situate it within the theoretical, and empirically-based, framework of SDT. In this sense the intended audiences are two. On the one hand it aims to provide a first glimpse into the facilitation of autonomy supportive practices in an environment, both physical and pedagogical, that has not been explored before. In this sense it extends an invitation to other researchers who work within the fields of nature-based education, or SDT, to further examine the facilitation of autonomy support. On the other hand, as with all of my work, my ambition is that it is accessed and used by practitioners to question, reflect upon and, if appropriate in their settings, to enrich practice. It is also a useful start in a greater and ongoing dialogue pertaining to autonomy in outdoor settings that I would like to initiate and facilitate.

With this in mind, the following dissemination strategies have been developed in relation to this article. The first one relates to direct contact and an ongoing discussion with practitioners. To this effect, I have nurtured several professional partnerships in the field that allow me to present my work directly to practitioners, in professional development sessions and other formal and informal opportunities. This is a chance, not only to directly impact on practice, but also to continue the dialogue that informs my own next steps for research, including generating new questions and correcting my own course in how I view the field and it needs when needed. When informally sharing the results of this study with practitioners, an experienced practitioner and nature nursery manager described the paper as “pure gold” (Burgess,

personal communication, September 14th 2019). For that reason, it was deemed useful to create an infographic that can be shared with practitioners and across social media, in the hope that it will be used in practice Appendix iv, Section b). The infographic has now been shared with over 10,000 practitioners through social media channels.

Limitations

The study presents a snapshot of current practice, limited in time and space. Both of these aspects can be of significance, as they do affect practice in nature-based settings. For example time of year, as well as the type of forest the practice takes place in, can significantly change practice. This was noted by practitioners, and is mentioned in the paper. A deeper investigation would have included longer amounts of time that encompassed more settings and different seasons.

Methodologically, ethnography presented the best fit for this study, with the two major characteristics of the methodology applicable in this case, namely that the observations took place in a natural setting, and that the researcher has an understanding of the perception of events by those involved in them (Nurani, 2008). In this case, the second characteristic was only partially applicable, as I was not able to explore the perspectives of the children within the settings observed. Due to limitations in the ethical permission obtained, as well as time limitations, the children were not interviewed in this occasion. Further research on this topic would directly explore the children's perception and understanding of the actions taken by the practitioners to facilitate autonomy.

A second, more general limitation relating to the methodology, is that of reliability in ethnographic research as identified by LeCompte and Goetz (1982). Replication of research that has used ethnographic approaches is usually impossible, due to the natural setting it takes place in (Nurani, 2008). There was some attempt to mitigate this limitation in the use of more than one settings in this particular study, with several of the themes arising independently in more than one setting, and, therefore, I am confident that the observations recorded, although situated in time and space, as mentioned above, would still have some

significance for practitioners in similar yet different settings.

Another clear limitation of this particular paper is the absence of place-based pedagogies as those are used to promote autonomy within outdoor learning settings. A lot of the pedagogical practice that was observed clearly stemmed from or was inspired by place-based education principles, as these are described in David Sobel's work (2008). Instead the focus remained narrower, on the psychological rather than the pedagogical perspectives. Future articles would benefit from developing a broader perspective that links the two, creating a more holistic picture.

Absent from the paper, the article would have benefited from a clearer link between autonomy support and nature connection. This is only alluded to in the original paper, but should have perhaps been made more central in the argument and within the literature presented in the final version of the article, that had to be shortened several times in order to meet the journal's word limit. The point that should have been made clearer is the inter-connectedness of all three basic psychological needs, and how by supporting one, the other two are also nurtured (Ryan & Deci, 2017).

Despite limitations the paper remains a starting point for further research in the ways that practitioners promote and support autonomy in nature settings. Such a project is currently underway, using different qualitative methodologies (Barrable, Boyle, Lindsey & McKenzie, in preparation) and is discussed in the final Chapter.

CHAPTER 6 - Nature relatedness in student teachers, perceived competence and willingness to teach outdoors: An empirical study (Barrable & Lakin, 2019; Appendix v)

Introduction

Despite the fact that outdoor learning, and especially learning in natural environments, has been often described as being an important aspect of policy and practice in education across the board, in both Scotland (Christie, Higgins and Nicol, 2015) and in the rest of the UK (Ofsted, 2008), barriers to implementation are often reported. These include cost and accessibility to appropriate places, although teacher confidence in delivering effective learning outdoors is also an important aspect (Nundy, Dillon & Dowd, 2009; O'Donnell, Morris & Wilson, 2006).

Two routes of improving teachers' confidence have been identified: continuous professional learning within schools, and Initial Teacher Education (ITE; University of Edinburgh, 2016). Barrable and Lakin (2019) paper was initially an attempt to evaluate the learning taking place during an outdoor session delivered as part of undergraduate and postgraduate ITE. As we looked into the activities delivered and the outcomes we wished to achieve, a research project emerged. We decided to use a validated scale to capture possible changes in nature connection, one adapted scale to measure perceived competence to teach outdoors, and one 3-item scale designed by the researchers to attempt to capture changes in willingness to teach outdoors.

Originality and Significance

This is the first piece of research to look at changes in nature connection in student teachers, and how that may impact their confidence to teach in natural environments. It employs a methodology that has been used before, in different populations and for different purposes, namely to measure the effect of an intervention on nature connection, usually in order to evaluate pro-environmental attitudes post an

environmental education intervention (see for example for use with secondary pupils, Ernst & Theimer, 2011; for use with biology undergraduates, Lankenau, 2018). In this instance, we put forward five hypotheses, that related both to the effect of the intervention on nature connection, as measured by the NR scale (Nisbet et al., 2009), as well as an increase in both perceived competence and willingness to teach outdoors. Although well-grounded in the literature that was presented in the paper, the hypotheses were novel, and aimed to critically look at some of the current practice in ITE, as it relates to outdoor education and learning in natural environments. The significance of the paper lies in its recommendations for practice, and the implications that it has on how we undertake instruction within ITE, as well as the relationship between nature connection and willingness to teach outdoors.

Intended Audience and Dissemination

Barrable and Lakin (2019) paper was written primarily with ITE institutions and educators in mind. It employed literature from Higher Education and ITE, and sought to address a question that is solely within the realm of ITE. In this sense, it is rather different from the other papers contained within this thesis, in that it has a much narrower scope. It does, however, provide a useful tool for educators working within ITE and succeeds in further adding to the evidence-based practice that is currently being used in Higher Education. Moreover, it has had an effect on our practice within the University of Dundee ITE courses, with more practical and experiential work now comprising the bulk of our instruction in relation to outdoor and nature-based learning, both in the MA (Hons) programme, as well as on the PGDE. The Botanic gardens continue to play a significant role in how we approach instruction in these two cohorts.

The paper was initially presented at the ‘Nature Connections 4’ conference, in July 2018, and attracted attention from a variety of professionals, both working within ITE in England and Wales, as well as those delivering continuous professional learning sessions within schools. It was then submitted, peer- reviewed and published in the Journal for Adventure Education and Outdoor Learning, which is the official journal of the Institute of Outdoor Learning in the UK.

Limitations

There are several limitations to this study, most of them addressed in the relevant section of the paper. Some of those relate to the design of the study, which could have included a control group; the sample size, which is adequate, but could have been larger in order to decrease type I error; and lack of follow- up. The design of the study was unfortunately constrained by timetable issues, and although a waiting list control group was discussed, it was impossible to timetable two sessions in the Botanical gardens. The same reason applied to the use of randomisation that would have strengthened the design further.

A limitation that was not mentioned in the published paper, due to the fact that I have since undertaken extensive training in statistics, relates to the analysis of results. In this instance, more limited use of independent statistical tests (such as the t-test that was used in the paper), substituted instead by omnibus statistical tests, such as an Analysis of Variance (ANOVA) would have been good. This would also have controlled for possible multiple comparison error. Such a multiple comparison correction, e.g. Bonferroni correction, should have been performed in this analysis (McDonald, 2009).

This paper was an initial venture into looking at the relationship between nature connection and higher education, in this instance initial teacher education. Future research projects may wish to explore broader applications of nature connection interventions not only for student teachers, but to support and enhance wellbeing and functioning within an academic environment. Such a project is currently underway through Human-Nature, a social enterprise that has employed me and a colleague as independent consultants to analyse their quantitative and qualitative results. The project is expected to conclude in May 2020.

Discussion and Future Directions

This thesis, and the papers contained therein, make a case for nature connection, the construct that describes a positive human-nature relationship, as a worthwhile goal for all education and describe some of the ways that this could be achieved in the context of early childhood (Barrable, 2019b; 2019c) and higher education (Barrable & Lakin, 2019). This thesis, and indeed the papers within it, does not put forward a *novel* version of nature connection. It takes the constructs that are traditionally used in environmental psychology, as these are explored and outlined in Chapter 2, and brings them together to an amalgamation, a latent construct of connectedness and positive human-nature relationship. The aspects of this connection remain the same, in that there are affective, behavioural and cognitive elements involved. However, it is not the sum of these parts alone that constitutes connection to nature, but rather our very nature and evolutionary history – the fact that we *are* nature and nature is *us.*

The reasons nature connection was chosen as a goal of education hinge upon, on the one hand, the positive associations of nature connection with various types of wellbeing (Capaldi et al., 2014; Nisbet & Zelenski, 2013, Sobko et al., 2018) as well as, given the current global challenges relating to climate change and ecological destruction, the positive correlation between nature connectedness and pro-environmental attitudes and behaviours (Nisbet, Zelenski & Murphy, 2009; Otto & Pencini, 2017).

Because of these positive associations outlined in details throughout the thesis, as well as the importance of early childhood as a time to nurture nature connectedness (Wells & Lekies, 2006), it has been identified as a worthwhile goal of outdoor education (Barrable & Arvanitis, 2018), as well as a possible distinct goal of early years' education (Barrable, 2019a).

Previous literature has called for a (re)-connection of children and nature (Louv, 2008; National Trust, 2019; Zylstra et al., 2014) and yet, nature connection, as a psychological construct, has not before been articulated as a distinct goal of education as a whole. Frantz and Mayer (2014) did put forward that promoting nature

connection should be seen as a goal in secondary environmental education programmes, basing their argument primarily on the research that links nature connection with pro-environmental behaviour. This thesis, and the articles it is based on, extends this argument, using the latest research from psychology, to put forward nature connection as a goal of all education, starting in early childhood and up to, and including higher education. The timing of this call that the thesis puts forwards could not be more urgent, given the Holocene mass extinction and climate change (Lyons et al., 2016; Turvey & Crees, 2019) as an emotional connection can be one of the motivating factors towards making pre-environmental and sustainable behaviours (Ives et al., 2018). As Learning for Sustainability becomes more embedded into curricula around the world (Croft, 2017) cultivating a clear sense of belonging to, and caring for, the natural world can present one pathway to enacting self-directed sustainable behaviours.

As the thesis, and the papers contained within it, focuses mainly on psychological literature to inform education, it sometimes fails to acknowledge the contribution of pedagogical literature that has contributed to building curricula and frameworks. These include place-based pedagogies (for example in Sobel, 2008 and Anderson, 2017), environmental education for sustainability (Tilbury, 1995) and experiential education theory (Kraft & Sakofs, 1985). Touching upon these pedagogical perspectives would have enriched the psychological aspects that are explored within the thesis, and could have added another layer of practice-focused application to the works contained within. In this sense, this thesis falls under the category of applied ‘psychology in education’ rather than one of pedagogical practice.

Each Chapter of this thesis has looked at a distinct area of theory or research in relation to nature connection, following the path that I myself took to engage with some of the concepts and as a researcher. Chapter 1, on Barrable & Arvanitis (2018), focused on providing a framework for nature- based practice based on SDT. This was a pivotal point in my own research focus that highlighted the role of nature connection in education. For that reason, Chapter 2, looks at nature connection within as a construct social and environmental psychology, and in the literature, providing a context for a closer look into how nature connection can be a goal of early childhood education (Barrable, 2019a), as explored in Chapter 3.

Chapter 4 is an attempt to provide an evidence-based framework for enacting environmental education in early childhood that enhances nature connection. Within that four key areas for development are emphasised, namely sustained contact with nature, cultivating of empathy, mindful practice and using the senses to appreciate the beauty of nature (Barrable, 2019b). Bridging this practice with SDT further highlights the importance of autonomy supportive study, and Chapter 5 presents an ethnographic study in Scotland that explores some of the practical manifestations of it as presented in Barrable (2019c).
Finally, Chapter 6 presents a study that brings forward nature connection as a goal of higher education, in the case of ITE. The empirical study explored in that Chapter comes from Barrable & Lakin (2019).

The work presented within this thesis comprises a modestly novel contribution to knowledge in the area of education, but can be used a springboard to refocus educational goals, as well as for further research. The latter will be explored in the next and final section of this Chapter.

Recommendations for policy and practice

A clear motivation for undertaking and disseminating this research is that it makes a difference to practice, and policy down the line. I can see these taking shape within three different spheres of influence: one within direct contact and dissemination to practitioners, the other through teacher education and the third, a far-reaching goal of influencing practice from the policy level.

Within these spheres there are distinct outcomes and processes that would be beneficial to children. Refocusing the educational process in a way that promotes nature connection, was summarized in the text and graphic in Barrable 2019a, and revolves around the pathways to connection, namely mindfulness, empathy, beauty and sustained contact. This is a suitable framework for all ages and stages of education, formal and informal. Promoting autonomy within that, in the ways outlined in Barrable 2019c, can further nurture this intimate relationship with the natural world. Although Barrable 2019c is written with a focus on natural settings, such as nature nurseries, with tweaks it can apply to more formal settings, including

traditional schools. The premise of the child as an autonomous learner is a worthwhile goal for practitioners, both in the early years and beyond.

On a policy level, the goal is to be able to promote nature connection not just in specialist settings, such as nature nurseries and forest schools, but through all education. For that to happen, nature connection, not simply as an abstract idea but clearly articulated as the psychological construct that encompasses cognitive, affective and behavioural aspects would have to be recognised as a distnict goal. This points is made in Barrable 2019b. Working towards that goal would include ensuring understanding for qualifying practitioners and teachers in ITE. Highlighting the importance of nature connection, the positive associations it has and its role as a basic human psychological need would be a crucial part of this process. Continuing to work on an evidence-base of how to nurture it, in order to be able to support and develop evidence-based practice is examined in the following section.

Directions for further research

As an active researcher in the area of nature connection in childhood, I have several ongoing projects currently in various stages, ranging from ethical approval to being in review for publication. This section will briefly outline these, as they relate to the work described within the thesis, as well as future projects, grant applications and planned collaborations. There are currently three papers, in relation to nature connection in education, that are under review. The first, data collection for which took place at the same time as for Barrable & Lakin (2019) focuses on student teachers' experiences before and during ITE that are seen by them as motivating them to undertake teaching outdoors when in placement and into their teaching practice (Barrable, Touloumakos & Lapere, in review). It is a qualitative study, utilising interviews to capture these experiences and student teachers' dispositions.

The second paper is a mini-review of nature connection interventions in childhood (Barrable & Booth, in review). It captures and describes the current state of the literature, as well as draws conclusions through a close look at effect sizes

reported within the studies, on the effectiveness of the various interventions, as well as other moderating factors. A longer, realist evaluation is planned to be undertaken. Realist evaluations are primarily used in health care to address complex problems that have complex solutions (Pawson, Greenhalgh, Harvey, & Walshe, 2005). The aim to bring together literature, practice and expert opinion to critically assess solutions to challenges; in this case increasing nature connection in children and young adults.

The final paper currently in review is a large quantitative study of pre-schoolers connection to nature, using the Connection to Nature Parents of Preschool Children scale (Sobko et al., 2018). This cross- sectional study presents data from over 200 children and compares children who attend nature preschools with those in more traditional settings (Barrable & Booth, in review). Findings indicate that children in nature nurseries do have higher nature connection than those in traditional settings, although the largest predictor of nature connection in pre-schoolers tends to be parental connection to nature.

Three more papers are in preparation, with analysis and writing underway. The first is a qualitative study of practitioners' perspectives on supporting autonomy in nature nurseries. As with Barrable (2019c) presented above, the paper employs a qualitative methodology, but in larger scale, this time in the form of open ended questionnaires, as well as responses to scenarios, to capture autonomy supportive practices (Barrable, Boyle, Lindsey & McKenzie, in preparation).

Data for a large study that looks at correlates between activities undertaken and connection to nature, as well as to affective wellbeing has already been collected from schools in England and Scotland. This cross-sectional study aims to identify activities that are associated, positively or negatively, with nature connection in children aged 8-11 (Barrable, Lumber, Cudworth & Booth, in preparation).

Finally, a small randomised controlled trial has been undertaken in undergraduates to see the effect of using technology in order to enhance our appreciation of beauty in nature, and nature connection. Data has been collected, with a further data collection due in a few months. Initial analysis has identified a small effect of using technology (a smart phone) to appreciate every day nature in enhancing nature connection (Barrable & Booth, in preparation).

As part of my further development as a researcher, I have applied for a small grant to fund the development and validation of an instrument to capture nature connection in younger children (aged 4- 8), which currently doesn't exist. Finally, future research will aim to further explore autonomy and its link to nature connection, within SDT, as well as a longitudinal study that will aim to look at the short- and long-term impact on nature-based early years' practice (such a forest school or nature nurseries) on nature connection and pro-environmental behaviours.

The above ongoing and planned research is in some ways a testament to the journey that is described within this thesis, both in personal terms, and in terms of my own epistemological and methodological development. In some ways, the process and the products have illuminated my own direction as one that is guided by critical realism. It is my ambition, in the future, to be able to use empirical findings and translate them into theory based interventions, while being aware of the cultural and social contexts. In my view, this is one of the ways that will bring about large-scale change, including in policy and practice. Ongoing mixed-methods evaluations of practice will be crucial in providing the evidence that will drive change on policy, both within a national and international level in the long term, and I wish to be able to be part of this process.

Conclusion

At a time of major environmental challenges that require decisive and radical action, in policy and from the individual, nature connection has been identified as a motivating factor to enact this action (Ives et al., 2019). This thesis not only puts forward persuasive arguments relating to engaging with nature in a new way that will benefit both our own as well as the planet's wellbeing, it also presents some research- informed ways that this could be achieved within different educational levels and settings. It brings together research, such as environmental psychology, into the context of educational practice and policy. These include formal and informal education, and span from early childhood to higher education. However, this thesis represents only the very beginning of my research journey in this area and highlights both the process and the products, and maps my future trajectory

conducting high quality research on nature connection in education.

References

Aitken, N. M., Pelletier, L. G., & Baxter, D.E. (2016). Doing the difficult stuff: Influence of self-determined motivation toward the environment on transportation pro-environmental behaviour. *Ecopsychology, 8*, 153-162. doi: 10.1089/eco.2015.0079

Anderson, S. K. (2017). Bringing school to life: Place-based education across the curriculum. Rowman & Littlefield.

Andreadakis, E., Joussemet, M., & Mageau, G. A. (2018). How to support toddlers' autonomy: Socialization practices reported by parents. *Early Education and Development*, *28* (2), 1-18.

Andrejewski, R. G. (2010). Nature connection, outdoor play, and environmental stewardship in residential environmental education. Doctoral thesis. Available online: https://etda.libraries.psu.edu/files/final_submissions/5151 (accessed on 5 May 2019)

Andrejewski, R., Mowen, A. J., & Kerstetter, D. L. (2011). An Examination of Children's Outdoor Time, Nature Connection, and Environmental Stewardship. Available online: https://scholarworks.umass.edu/cgi/viewcontent.cgi?referer=https://www.google.co.uk/&httpsredir=1&article=1001&context=nerr (accessed on 24 April 2019).

Arvanitis, A., & Kalliris, K. (2017). A self-determination theory account of self-authorship: Implications for law and public policy. *Philosophical Psychology*, *30*(6), 763-783.

Australian Government (2009). *Belonging, Being & Becoming - The Early Years Learning Framework for Australia* Accessed 15 May 2018 https://docs.education.gov.au/node/2632

Ball, J. (2004). As if Indigenous knowledge and communities mattered: Transformative education in First Nations communities in Canada. *American Indian Quarterly*, 454-479.

Bandura, Albert. 1977. "Self-efficacy: Toward a unifying theory of behavioural change." *Psychological Review*, 84(2), 191–215.

Barfod, K. S. (2018). Maintaining mastery but feeling professionally isolated: experienced teachers' perceptions of teaching outside the classroom. *Journal of Adventure Education and Outdoor Learning*, *18(3*), 201-213.

Barfod, K., & Mygind, L. (2018). *Udeskole in Denmark: A Narrative of Mutual Support and Sharing.* In The Palgrave International Handbook of Women and Outdoor Learning (pp. 721-729).

Palgrave Macmillan, Cham.

Barrable, A., (2019a) Refocusing environmental education in the early years: A Brief Introduction to a Pedagogy for Connection, *Education Sciences, 9* (1). https://doi.org/10.3390/educsci9010061

Barrable, A., (2019b). The case for nature connectedness as a distinct goal of early childhood education, International Journal of Early Childhood Environmental Education, 6 (2)

Barrable, A., (2019c). Shaping space and practice to support autonomy: Lessons from natural settings in Scotland, *Learning Environments Research*

Barrable, A., & Arvanitis, A. (2018). Flourishing in the forest: Looking at forest school through a Self- Determination Theory. Journal of Outdoor and Environmental Education. https://doi.org/10.1007/ s42322-018-0018-5

Barrable, A. & Barnett, J. H., (2016). *Growing up happy: Ten ways to increase your child's happiness and wellbeing*, London: Little, Brown

Barrable, A. & Barrable, D., (2017). *Growing up wild: 30 great ways to get your kids outdoors*, London: Little, Brown

Barrable, A., & Booth, D. (2020). Nature Connection in Early Childhood: A Quantitative Cross-Sectional Study. *Sustainability*, *12*(1), 375.

Barrable, A., & Jindal-Snape, D. (2019) *Protocol for a realist evaluation of interventions to increase nature connection in children.* Poster session presented at the 5th Annual Nature Connections Conference, Derby, UK.

Barrable, A., & Lakin, L. (2019). Nature relatedness in student teachers, perceived competence and willingness to teach outdoors: An empirical study, J*ournal of Adventure Education and Outdoor Learning* https://doi.org/10.1080/14729679.2019.1609999

Barrable, A., Touloumakos, A., & Lapere, L., (under review) Exploring student teachers' motivations and sources of confidence: The case of outdoor learning, *European Journal of Teacher Education*

Battiste, M. (2009). Naturalizing Indigenous knowledge in Eurocentric education. *Canadian Journal of Native Education*, 32(1), 5.

Baxter, D. E., & Pelletier, L. G. (2019). Is nature relatedness a basic human psychological need? A critical examination of the extant literature. *Canadian Psychology/psychologie canadienne*. *60* (1), 21-34

Bletzer, K. V. (2015). Visualizing the qualitative: making sense of written comments from an

evaluative satisfaction survey. *Journal of Educational Evaluation for Health Professions, 12*, 12

Bracken, S., (2010) Discussing the Importance of Ontology and Epistemology Awareness in Practitioner Research. *Worcester Journal of Learning and Teaching (4)*. Accessed 26th June 2019, Available at https://eprints.worc.ac.uk/843/

Brady, W. (1997). Indigenous Australian education and globalisation. *International Review of Education, 43*(5-6), 413-422.

Bronfenbrenner, U., & Morris, P. A. (2006). *The Bioecological Model of Human Development*. In R. M. Lerner & W. Damon (Eds.), Handbook of child psychology: Theoretical models of human development (pp. 793-828). Hoboken, NJ, US: John Wiley & Sons Inc

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative research in psychology, 3(2), 77-101.

Bruni, C. M., Ballew, M. T., Winter, P. L., & Omoto, A. M. (2018). Natural History Museums May Enhance Youth's Implicit Connectedness with Nature. *Ecopsychology, 10*(4), 280-288.

Borsboom, D. (2005). *Measuring the mind: Conceptual issues in contemporary psychometrics*. Cambridge University Press.

Capaldi, C. A., Dopko, R. L., & Zelenski, J. M. (2014). The relationship between nature connectedness and happiness: a meta-analysis. *Frontiers in Psychology, 5*, 976.

Care Inspectorate, (2018). *My World Outdoors*, Accessible online at https://hub.careinspectorate.com/how-we- support-improvement/care-inspectorate-programmes-and-publications/my-world-outdoors/ Accessed 21 April 2019

Carone, G. R. 2001. The Classical Greek Tradition. In *A Companion to Environmental Philosophy*, edited by D. Jamieson. Oxford: Blackwell Publishers, 67-80.

Centre for Early Childhood Development and Education (2006). *Síolta* Available online at https://www.earlychildhoodireland.ie/work/quality-practice/national-frameworks/ Accessed 21 April 2019

Charles, C., Louv, R., Bodner, L., & Guns, B. (2008). Children and Nature 2008. A Report on the Movement to Reconnect Children to the Natural World. Santa Fe: Children and Nature Network, 9-11.

Chawla, L. (2015). Benefits of nature contact for children. *Journal of Planning Literature*, 30(*4*), 433-452. Cheng, J. C.-H. & Monroe, M. C. (2012). Connection to nature: Children's affective attitude toward nature. *Environment and Behaviour, 44*(1), 31–49. doi:10.1177/0013916510385082

Clayton, S. (2003). Environmental identity: A conceptual and operational definition in Clayton, S. & Opotow, S. (eds) *Identity and the Natural Environment.* Boston MA: MIT Press.

Clayton, S. (2012). *Environment and Identity. The Oxford Handbook of Environmental and Conservation Psychology.* New York: Oxford University Press

Côté-Lecaldare, M., Joussemet, M., & Dufour, S. (2016). How to support toddlers' autonomy: A qualitative study with child care educators. *Early Education and Development, 27*(6), 822-840.

Collado, S., Staats, H., & Corraliza, J. A. (2013). Experiencing nature in children's summer camps: Affective, cognitive and behavioural consequences. *Journal of Environmental Psychology*, *33*, 37-44.

Cremeens, J., Eiser, C., & Blades, M. (2006). Factors influencing agreement between child self-report and parent proxy-reports on the Pediatric Quality of Life Inventory™ 4.0 (PedsQL™) Generic Core Scales. *Health and quality of life outcomes*, *4*(1), 58.

Crockett, D. (2014) *Nature Connection Will Be the Next Big Human Trend.* Available at https://www.huffingtonpost.co.uk/daniel-crockett/nature-connection-will-be-the-next-big-human-trend_b_5698267.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAAFYq4ktZzGapk3VTT6lWY71QRW-Hljy26qQrFdX7GQ60Ox12HRQwvy6uMupml-NviotnP5L6QeV483QpHv5_H4fZ_K4UiynO7rh0ms9HCa6QZ9wFlweDDGF6ZHhfl9e77-tJ-ut0oV4OZpWUSw-kiZRJHamGLbdQCGSgftRCuPF6 Accessed 20th September 2019

Croft, A. (2017). Leading the change toward education for sustainability in early childhood education. *He Kupu, 5*(1), 53-60.

Dahl, T. I., Sethre-Hofstad, L., & Salomon, G. (2013). Intentionally designed thinking and experience spaces: What we learned at summer camp. *Learning Environments Research*, *16*(1), 91-112.

Davis, J. (1998). Young children, environmental education, and the future. *Early Childhood Education Journal*,
26(2), 117-123.

Davis, J. (2009). Revealing the research 'hole' of early childhood education for sustainability: A preliminary survey of the literature. *Environmental Education Research, 15*(2), 227-241. https://www.tandfonline.com/doi/abs/10.1080/13504620802710607

Davis, J. L., Green, J. D. & Reed, A. (2008). Interdependence with the environment:

Commitment, interconnectedness, and environmental behaviour. *Journal of Environmental Psychology*, *29*, 173-180. doi: 10.1016/j.jenvp.2008.11.001

Deci, E. L., & Ryan, R. M. (1980). Self-determination theory: When mind mediates behavior. *The Journal of Mind and Behavior*, 33-43.

Deci, E. L., & Ryan, R. M. (2008). Self-determination theory: A macrotheory of human motivation, development, and health. *Canadian psychology/Psychologie canadienne*, *49*(3), 182.

Department for Education (2017). *Statutory framework for the early years foundation stage* Availabe online

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/596629/EYFS_ STATUTORY_FRAMEWORK_2017.pdf Accessed 22 April 2019

DeRobertis, E. M., & Bland, A. M. (2018). Tapping the humanistic potential of self-determination theory: Awakening to paradox. *The Humanistic Psychologist*, *46*(2), 105.

Dettweiler, U., Ünlü, A., Lauterbach, G., Becker, C., & Gschrey, B. (2015). Investigating the motivational behavior of pupils during outdoor science teaching within self-determination theory. *Frontiers in Psychology*, *6*. https://doi.org/10.3389/fpsyg.2015.00125.

Dewey, J. (1962). *The relation of theory to practice in education* (pp. 9-30). Cedar Falls, Iowa: Association for Student Teaching.

Doyle, J., & Milchem, K. (2012). *Developing a Forest School in early years provision*. London: Practical Pre- School Books.

Fischhoff, B. (2013). The sciences of science communication. Proceedings of the National Academy of Sciences, 110(Supplement 3), 14033-14039.

Frantz, C. M., & Mayer, F. S. (2014). The importance of connection to nature in assessing environmental education programs. *Studies in Educational Evaluation*, *41*, 85-89.

Forest School Association. (n.d.). What is forest school? Available online at http://www.forestschoolassociation.org/what-is-forest-school/ Accessed 25 April 2019

Goodman, R. (2001). Psychometric properties of the strengths and difficulties questionnaire. Journal of the American Academy of Child & Adolescent Psychiatry, 40(11), 1337-1345.

Grant, C. (2011). Diversifying and transforming the doctoral studies terrain: A student's experience of a thesis by publication. *Alternation*, 18(2), 245-267.

Greenhalgh, T., & Peacock, R. (2005). Effectiveness and efficiency of search methods in systematic reviews of complex evidence: audit of primary sources. Bmj, 331(7524), 1064-1065.

Greenhalgh, T., Wong, G., Jagosh, J., Greenhalgh, J., Manzano, A., Westhorp, G., & Pawson, R. (2015). Protocol—the RAMESES II study: developing guidance and reporting standards for realist evaluation. BMJ open, 5(8), e008567.

Grinde, B., & Patil, G. G. (2009). Biophilia: does visual contact with nature impact on health and well-being?. *International Journal of Environmental Research and Public Health*, *6* (9), 2332-2343. https://dx.doi.org/10.3390%2Fijerph6092332

Hagger, M. S., & Chatzisarantis, N. L. (2007). *The trans-contextual model of motivation*. In M. S. Hagger & N. L. D. Chatzisarantis (Eds.), Intrinsic motivation and self-determination in exercise and sport (pp. 53–70). Champaign, IL: Human Kinetics.

Harris, F. (2017). The nature of learning at forest school: practitioners' perspectives. *Education 3-13*, 45(2), 272-291.

Hart, V., Whatman, S., McLaughlin, J., & Sharma-Brymer, V. (2012). Pre-service teachers' pedagogical relationships and experiences of embedding Indigenous Australian knowledge in teaching practicum. *Compare: A Journal of Comparative and International Education, 42*(5), 703-723.

Hartig, T., Evans, G. W., Jamner, L. D., Davis, D. S., & Gärling, T. (2003). Tracking restoration in natural and urban field settings. *Journal of Environmental Psychology, 23*(2), 109-123. https://doi.org/10.1016/S0272- 4944(02)00109-3

Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world?. Behavioral and brain sciences, 33(2-3), 61-83.

Howell, A. J., Dopko, R. L., Passmore, H. A., & Buro, K. (2011). Nature connectedness: Associations with well- being and mindfulness. *Personality and individual differences, 51(*2), 166-171.

Ivankova, N. V., Creswell, J. W., & Stick, S. L. (2006). Using mixed-methods sequential explanatory design: From theory to practice. *Field methods*, *18*(1), 3-20.

Ives, C. D., Abson, D. J., von Wehrden, H., Dorninger, C., Klaniecki, K., & Fischer, J. (2018). Reconnecting with nature for sustainability. *Sustainability science*, *13*(5), 1389-1397.

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational researcher*, *33*(7), 14-26.

Joye, Y., & De Block, A. (2011). 'Nature and I are Two': A Critical Examination of the Biophilia Hypothesis. Environmental Values, 20(2), 189-215.

Kahn, P. H. (1999). *The Human Relationship with Nature: Development and Culture*. Cambridge, MA: MIT Press

Kellert, S. R. (2012). Building for life: Designing and understanding the human-nature

connection. Washington D.C: Island press.

Kellert, S. H. & Wilson, E. O. (1995). *The Biophilia Hypothesis*. Washington D. C: Island press

Kingsley, J. Y., Townsend, M., & Henderson-Wilson, C. (2013). Exploring Aboriginal people's connection to country to strengthen human-nature theoretical perspectives. *Ecological health: Society, ecology and health*, 15, 936-944.

Knight, S. (Ed.). (2011). Forest school for all. London: Sage.
Knight, S. (2018). Translating Forest School: A response to Leather. *Journal of Outdoor and Environmental Education, 21*(1), 19-23.

Kopnina, H. (2012). Education for sustainable development (ESD): the turn away from 'environment'in environmental education?.g*Environmental Education Research*, 18(5), 699-717.

Korthagen, F. A., Kessels, J., Koster, B., Lagerwerf, B., & Wubbels, T. (2001). *Linking practice and theory: The pedagogy of realistic teacher education*. London: Routledge

Kossack, A., & Bogner, F. X. (2012). How does a one-day environmental education programme support individual connectedness with nature?. *Journal of Biological Education, 46*(3), 180-187.

Kraft, R. J., & Sakofs, M. (1985). The Theory of Experiential Education. Association for Experiential Education: Boulder, CO.

Lavergne, K., & Pelletier, L. G. (2015). Predicting individual differences in the choice of strategy to compensate for attitude-behaviour inconsistencies in the environmental domain. *Journal of Environmental Psychology*, 44, 135-148. doi: http://dx.doi.org/10.1016/j.jenvp.2015.10.001

Leather, M. (2012). Seeing the wood from the trees: Constructionism and constructivism for outdoor and experiential Education. Edinburgh: University of Edinburgh. Available at http://oeandphilosophy2012. newhar bour. co. uk/wp-content/uploads/2012/04/Mark-Leather. pdf. (Accessed August 2019)

Leather, M. (2018). A critique of "Forest School" or something lost in translation. *Journal of Outdoor and Environmental Education, 21*(1), 5-18.

LeCompte, M. D., & Goetz, J. P. (1982). Problems of reliability and validity in ethnographic research. *Review of educational research, 52(*1), 31-60.

Liefländer, A. K., Fröhlich, G., Bogner, F. X., & Schultz, P. W. (2013). Promoting connectedness with nature through environmental education. *Environmental Education Research, 19*(3), 370-384.

Liu, W. C., Wang, J. C. K., & Ryan, R. M. (2015). *Building autonomous learners:*

Perspectives from research and practice using Self-Determination Theory. New York: Springer.

Louv, R., (2008) *Last child in the woods: Saving our children from nature-deficit disorder*. New York: Algonquin books

Lyons, S. K., Amatangelo, K. L., Behrensmeyer, A. K., Bercovici, A., Blois, J. L., Davis, M., ... & Graves, G. R. (2016). Holocene shifts in the assembly of plant and animal communities implicate human impacts. *Nature*, *529*(7584), 80.

Makovichuk, L., Hewes, J., Lirette, P., & Thomas, N. (2014). *Play, participation, and possibilities: An early learning and child care curriculum framework for Alberta*. Available online at http://childcareframework.com/resources/Play,%20Participation,%20and%20Possibilities%20-%20An%20Early%20Learning%20and%20Child%20Care%20Curriculum%20Framework%20for%20Albe rta.pdf Accessed August 2018

Manne, S. L., Jacobsen, P. B., & Redd, W. H. (1992). Assessment of acute pediatric pain: do child self-report, parent ratings, and nurse ratings measure the same phenomenon?. *Pain*, *48*(1), 45-52.

Martin, P. (2005). Human to nature relationships through outdoor education. *Outdoor and experiential learning: Views from the top*, 28-52.

Mausner, C. (1996). A kaleidoscope model: Defining natural environments. *Journal of Environmental Psychology*, *16*,335-348.

Mayer, F. S. & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology, 24*(4), 503–515. doi:10.1016/j.jenvp.2004.10.001

Mayer, F. S., Frantz, C. M., Bruehlman-Senecal, E., & Dolliver, K. (2009). Why is nature beneficial? The role of connectedness to nature. *Environment and behavior*, *41*(5), 607-643.

McDonald, J. H. (2009). *Handbook of biological statistics* (Vol. 2, pp. 6-59). Baltimore, MD: Sparky house publishing.

Miller, J. R. (2006). Restoration, reconciliation, and reconnecting with nature nearby. *Biological Conservation*, *127*(3), 356-361.

Mullenbach, L. E., Andrejewski, R. G., & Mowen, A. J. (2018). Connecting children to nature through residential outdoor environmental education. *Environmental Education Research*, 1-10

Moss, P. (2014). *Transformative change and real utopias in early childhood education: A story of democracy, experimentation and potentiality*. London: Routledge

Nedovic, S., & Morrissey, A. M. (2013). Calm active and focused: Children's responses to an organic outdoor learning environment. *Learning environments research*, *16*(2), 281-295.

Ng, J. Y., Ntoumanis, N., Thøgersen-Ntoumani, C., Deci, E. L., Ryan, R. M., Duda, J. L., &

Williams, G. C. (2012). Self-determination theory applied to health contexts: A meta-analysis. *Perspectives on Psychological Science, 7*(4), 325–340

Nisbet, E. K. (2005). The human-nature connection: Increasing nature relatedness, environmental concern, and well-being through education (Doctoral dissertation, Carleton University).

Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2009). The nature relatedness scale: Linking individuals' connection with nature to environmental concern and behavior. *Environment and Behavior, 41*(5), 715-740.

Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2011). Happiness is in our nature: Exploring nature relatedness as a contributor to subjective well-being. *Journal of Happiness Studies, 12*, 303-322, doi: 10.1007/s10902-010-9197- 7

Nisbet, E. K. & Zelenski, J. M. (2011). Underestimating nearby nature: affective forecasting errors obscure the happy path to sustainability. *Psychological science, 22*(9), 1101–6. doi:10.1177/0956797611418527

Nurani, L. M. (2008). Critical review of ethnographic approach. *Jurnal sosioteknologi, 7*(14), 441-447.

Otto, S., & Pensini, P. (2017). Nature-based environmental education of children: Environmental knowledge and connectedness to nature, together, are related to ecological behaviour. *Global Environmental Change, 47*, 88-94.

Pawson, R., Greenhalgh, T., Harvey, G., & Walshe, K. (2005). Realist review-a new method of systematic review designed for complex policy interventions. *Journal of health services research & policy, 10*(1_suppl), 21-34.

Pecl, G. T., Araújo, M. B., Bell, J. D., Blanchard, J., Bonebrake, T. C., Chen, I. C., ... & Falconi, L. (2017). Biodiversity redistribution under climate change: Impacts on ecosystems and human well-being. *Science*, 355(6332), eaai9214.

Pelletier, L. G., Dion, S., Tuson, K., & Green-Demers, I. (1999). Why do people fail to adopt environmental protective behaviors? Toward a taxonomy of environmental amotivation. *Journal of Applied Social Psychology, 29*(12), 2481-2504. http://dx.doi.org/10.1111/j.1559-1816.1999.tb00122.x

Pelletier, L. G., Green-Demers, I., & Béland, A. (1997). Pourquoi adopter des comportements écologiques? Validation de l'Échelle de Motivation envers l'Environnement.. *Revue Canadienne des Sciences du Comportement, 29*, 145-156.

Pereira, M., & Forster, P. (2015). The relationship between connectedness to nature, environmental values, and pro-environmental behaviours. *Reinvention: An international*

journal of undergraduate research, 8(2).

Perkins, H. E. (2010). Measuring love and care for nature. *Journal of Environmental Psychology, 30*(4), 455–463. doi:10.1016/j.jenvp.2010.05.004

Povee, K., & Roberts, L. D. (2015). Attitudes toward mixed methods research in psychology: the best of both worlds?. *International Journal of Social Research Methodology, 18*(1), 41-57.

Restall, B., & Conrad, E. (2015). A literature review of connectedness to nature and its potential for environmental management. *Journal of Environmental Management, 159*, 264-278.

Rosa, C. D., Profice, C., & Collado, S. (2018). Nature Experiences and Adults' Self-Reported Pro-environmental Behaviors: The Role of Connectedness to Nature and Childhood Nature Experiences. *Frontiers in psychology*, 9, 1055.

Reeve, J., & Jang, H. (2006). What teachers say and do to support students' autonomy during a learning activity. *Journal of Educational Psychology, 98*, 209–218.

Richardson, M., Hunt, A., Hinds, J., Bragg, R., Fido, D., Petronzi, D. Barbett, L., Clitherow, T. and White, M. (2019). A Measure of Nature Connectedness for Children and Adults: Validation, Performance, and Insights. *Sustainability. 11*(12), 3250; https://doi.org/10.3390/su11123250

Richardson, M., Sheffield, D., Harvey, C. & Petronzi, D. (2016) 'The Impact of Children's Connection to Nature: A Report for the Royal Society for the Protection of Birds (RSPB)', Royal Society for the Protection of Birds. Available at: http://www.rspb.org.uk/our-work/our-positions-and- campaigns/positions/education/research/connection-to-nature.aspx

Russell, R., Guerry, A. D., Balvanera, P., Gould, R. K., Basurto, X., Chan, K. M-A., Klain, S., Levine, J. & Tam, J. (2013). Humans and nature: how knowing and experiencing nature affect well-being. *Annual Review of Environment and Resources, 38*(6), 6.1-6.30. doi: 10.1146/annurev-environ-012312-110838

Ryan, A. B. (2006). *Post-positivist approaches to research. Researching and Writing your Thesis: a guide for postgraduate students*, 12-26.

Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness.* New York: Guilford Publications.

Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology*, 101860.

Ryan, R. M., & Moller, A. C. (2016). *Competence as a necessary but not sufficient condition for high quality motivation: A self-determination theory perspective*. In A. Elliot, C. Dweck, & D.

Yeager (Eds.), Handbook of Competence Motivation (2nd ed., pp. 214–231). New York: Plenum Press.

Ryan, R. M., Weinstein, N., Bernstein, J. H., Brown, K. W., Mistretta, L., & Gagné, M. (2010). Vitalizing effects of being outdoors and in nature. J*ournal of Environmental Psychology*, 30, 159-168.

San Jose, A. L., & Nelson, K. E. (2017). Increasing children's positive connection to, orientation toward, and knowledge of nature through nature camp experiences. *International Journal of Environmental and Science Education*, *12*(5), 933-944

Schratz, M., & Walker, R. (2005). Research as social change: New opportunities for qualitative research. London: Routledge.

Schultz, P. W., Shriver, C., Tabanico, J. J. & Khazian, A. M. (2004). Implicit connections with nature. *Journal of Environmental Psychology, 24*(1), 31–42. doi:10.1016/S0272-4944(03)00022-7

Senner, J. E., & Fish, T. (2012). Comparison of child self-report and parent report on the sibling need and involvement profile. *Remedial and Special Education, 33*(2), 103-109.

Sherman, A.K., Bird, S., Powers, S., Rowe, A., & Legault, L. (2016). Motivational orientation explains the link between political ideology and proenvironmental behavior. *Ecopsychology*, *8*(4), 239-249. doi: 10.1089/eco.2016.0029.

Sierens, E., Vansteenkiste, M., Goossens, L., Soenens, B., & Dochy, F. (2009). The synergistic relationship of perceived autonomy support and structure in the prediction of self-regulated learning. *British Journal of Educational Psychology, 79*(1), 57-68.

Smith, S. (2015). *PhD by published work: a practical guide for success*. London: Macmillan International Higher Education.

Soga, M., & Gaston, K. J. (2016). Extinction of experience: the loss of human–nature interactions. Frontiers in Ecology and the Environment, 14(2), 94-101.

Sobel, D. (2008). *Childhood and nature: Design principles for educators*. Stenhouse Publishers

Sobko, T., Jia, Z., & Brown, G. (2018). Measuring connectedness to nature in preschool children in an urban setting and its relation to psychological functioning. *PloS one, 13*(11), e0207057.

Sproule, J., Martindale, R., Wang, J., Allison, P., Nash, C., & Gray, S. (2013). Investigating the experience of outdoor and adventurous project work in an educational setting using a self-determination framework. *European Physical Education Review*, *19*(3), 315-328.

Tam, K. P. (2013). Concepts and measures related to connection to nature: Similarities and

differences. *Journal of Environmental Psychology, 34*, 64-78.

Tilbury, D. (1995). Environmental education for sustainability: Defining the new focus of environmental education in the 1990s. Environmental education research, 1(2), 195-212.

Trigwell, J. L., Francis, A. J., & Bagot, K. L. (2014). Nature connectedness and eudaimonic well-being: Spirituality as a potential mediator. *Ecopsychology, 6*(4), 241-251.

Turvey, S. T., & Crees, J. J. (2019). Extinction in the Anthropocene. *Current Biology, 29*(19), R982-R986.

University of Gothenberg, (2011). *'Taking children seriously': A new report on the EU childhood education for sustainable development*, Accessed 23 April 2019 https://phys.org/news/2011-01-children-seriously1046-eu- childhood-sustainable.html?utm_source=TrendMD&utm_medium=cpc&utm_campaign=Phys.org_TrendMD_1

Van den Berg, A. E., Hartig, T., & Staats, H. (2007). Preference for nature in urbanized societies: Stress, restoration, and the pursuit of sustainability. J*ournal of Social Issues*, *63* (1), 79-96. https://doi.org/10.1111/j.1540-4560.2007.00497.x

Vessonen, E. (2019). Operationalism and realism in psychometrics. *Philosophy Compass*, 14(10), e12624.

Vining, J., Merrick, M.S. and Price, E.A. (2008) The Distinction between Humans and Nature: Human Perceptions of Connectedness to Nature and Elements of the Natural and Unnatural. *Research in Human Ecology*, 15, 1-11.

Walden, C.H., (2007), *Nurture through nature: Working with children under 3 in outdoor environments*,
Edinburgh: Mindstretchers

Wang, C. K. J., Ang, R. P., Teo-Koh, S. M., & Kahlid, A. (2004). Motivational predictors of young adolescents' participation in an outdoor adventure course: A self-determination theory approach. *Journal of Adventure Education & Outdoor Learning, 4(*1), 57–65. https://doi.org/10.1080/14729670485200421.

Walsh, G., Sproule, L., McGuinness, C., Trew, K., & Ingram, G. (2010). Developmentally appropriate practice and play-based pedagogy in early years education. Accessed 12 May 2019 http://feedback.ccea.org.uk/sites/default/files/docs/research_statistics/early_years/Literature_Review.pdf .

Weinstein, N., Przybylski, A. K., & Ryan, R. M. (2009). Can nature make us more caring? Effects of immersion in nature on intrinsic aspirations and generosity. *Personality and*

Social Psychology Bulletin, 35, 1315-1329.

Wells, N. M., & Lekies, K. S. (2006). Nature and the life course: Pathways from childhood nature experiences to adult environmentalism. *Children Youth and Environments, 16*(1), 1-24.

Whitebread, D., Bingham, S., Vygotsky, L., Martin-Korpi, B., Martin-Korpi, B., & Ross, G. (2011). Developmental psychology and early childhood education. *Nursery World, 17*(9), 5-100.

Williams-Siegfredsen, J. (2017). *Understanding the Danish Forest School approach: Early years education in practice*. London:Routledge.

Wilson, E. O. (1984) *Biophilia.* Cambridge (MA): Harvard University Press, 1, 79.

Windhager, S., Atzwanger, K., Bookstein, F. L. & Schaefer, K. (2011). Fish in a mall aquarium—An ethological investigation of Biophilia. *Landscape and Urban Planning, 99*(1), 23–30. doi:10.1016/j.landurbplan.2010.08.008

World Health Organisation, (n.d.) Early child development, Accessed 26th June 2019, Available at https://www.who.int/topics/early-child-development/en/

Worroll, J., & Houghton, P., (2018*). A Year of Forest School: Outdoor Play and Skill-building Fun for Everyone,*
London: Watkins Publishing

Zylstra, M. J., Knight, A. T., Esler, K. J., & Le Grange, L. L. (2014). Connectedness as a core conservation concern: An interdisciplinary review of theory and a call for practice. Springer Science Reviews, 2(1-2), 119-143.

Appendix i

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ORIGI NAL PAPER

Flourishing in the forest: looking at Forest School through a self-determination theory lens

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Abstract

Forest School offers opportunities for children and young adults to come into regular contact with nature. Although, in relevant literature, Forest School is seen as highly conducive to participants' motivation to learn, there is no theoretical framework that examines how this motivation can be optimized in relation to Forest School pedagogy. Self-Determination Theory offers a broad perspective for motivational processes and will be used as a guide in this article to advance such a framework. Self-Determination Theory proposes that well-being, which has been identified as an aim of Forest School, is promoted through the support of three basic psychological needs for autonomy, competence and relatedness. In this conceptual article, we make links between Forest School pedagogical practices and Self-Determination Theory, mainly focusing on the support of children's basic psychological needs. Furthermore, we make suggestions for ways in which to enhance practice through explicit links with need-supportive teaching practices, as these are identified in the Self- Determination Theory literature.

Keywords Outdoor learning · Forest School· Self-determination theory· Autonomy· Nature relatedness· Challenge

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It is evident even to the casual observer that young children exhibit an inherent propensity to play and explore. How socializing agents, like parents and educators, are able to nurture this valuable intrinsic motivational tendency in ways that will help children *flourish*, that is, develop into thriving, vital, fully-functioning adults, is one of the basic areas of research for Self-Determination Theory (SDT; Deci and Ryan 2017). The main tenet of the theory is that individuals should be supported in ways that facilitate the expression of their intrinsic tendencies rather than be controlled externally through strict rules, rewards or punishments. Within an educational context, institutions and educators often rely on the use of positive reinforcements, such as grades and awards, or external pressure and punishment, in order to motivate children. There are fewer educational settings that attempt to capitalize on children's inherent motivational tendencies to learn, and later on, to achieve their educational goals. An example of the latter type of learner-centered approach is that of Forest School (FS), which nurtures children's curiosity and inherent tendencies to learn and explore the world around them, in a natural setting. We will outline the basic principles of SDT, as they relate to education and nature, and focus on how FS settings are conducive to the creation of an educational, physical and social environment that is in accordance with the principles of SDT. We posit that the proposed theoretical framework could be useful in enhancing practice in a way that keeps close to FS's pedagogical aims, as these are defined in the professional and academic literature.

Self determination theory and education

SDT is a psychological theory that illuminates the conditions and processes through which growth is optimized (Ryan and Deci 2017). These conditions, primarily social, are studied in their role as either facilitating or hindering human flourishing. The theory has a wealth of empirical evidence backing it, and has been used to interpret behaviors and motivational processes in many diverse fields of human endeavour, from education (Liu et al. 2015; Jang et al. 2010) and psychotherapy (Ryan and Deci 2008), to health care (Ng et al. 2012), sport (Hagger and Chatzisarantis 2007), and ethics (Arvanitis 2017). By highlighting motivational processes, the theory succeeds in exploring and explaining personality growth, development and the way humans relate to one another, as well as to their environments.

The starting point of SDT is that humans are active, growth-oriented organisms (Deci and Ryan 2000). As a motivational theory, it is focused on the energy of the organism and the ways in which that energy contributes to growth and integrity. Formally, SDT is a meta-theory that comprises six mini-theories, which have been developed through field and laboratory studies (Ryan and Deci 2017). One of these mini-theories of SDT, Cognitive Evaluation Theory (CET), is especially focused on understanding the energy that propels, for example, young children to be naturally curious, inquisitive and ready to experience the world around them. CET is generally concerned with understanding how and when activities are performed as a natural and authentic expression of individual intrinsic tendencies. Active engagement with an environment through this type of energy and enactment of natural tendencies is defined as *intrinsic motivation*, that is, being engaged in activities for their inherent satisfaction and not in order to attain a separable outcome. Intrinsic motivation is the most desirable type of motivation and is linked with many positive outcomes, including improved learning outcomes (Grolnick and Ryan 1987).

Although this form of motivation seems ideal, people cannot live their lives doing only what is inherently

satisfying. In fact, most of life involves activities that are done in order to attain a separable outcome. To simplify, these activities could be regulated by either external reasons, such as the avoidance of punishment, or more internal reasons, such as the observance of a personal value. According to SDT, there is a natural inclination for humans to transform regulation by external contingencies into self-regulation. The integration of social structures and experience into a unified sense of self is known as *organismic integration.* This is not possible with every external structure though and the process can exhibit a continuum of possibilities. Behavior may remain *externally regulated*, that is, performed for the attainment of a reward or the avoidance of punishment. Sometimes the regulation is swallowed but not digested (Perls 1973); therefore it is only partially internalized. This type of motivation is known as *introjection* or *introjected regulation*. *Regulation through identification* occurs when individuals have accepted the behavior, as they see value in it: this is a highly internalized and self-determined behavior. Finally, when *integrated regulation* occurs, the behavior is fully integrated and self-determined, in a way that is harmoniously assimilated with other values, needs and identities (Deci et al. 1991). Both integration and regulation through identification are considered *autonomous types of motivation*, along with intrinsic motivation.

From the perspective of the teacher, a primary objective is to support the children's natural inquisitiveness, that is, their intrinsic motivation to learn. Whenever this is not possible, motivating students through punishments and rewards or through invoking guilt and shame results in non-autonomous learning (i.e., in learning through external regulation or through introjected regulation, respectively). The purpose of a skillful teacher is, therefore, to facilitate deeper internalization of learning processes, materials or social norms, through organismic integration. For example, within FS, practitioners might want children to learn to respect and look after their environment and all living things. Since this is not something that is always interesting or enjoyable in itself, children may not be intrinsically motivated to learn. In this case, the learning objective is best achieved when motivation for such actions has been fully internalized (i.e., integrated), instead of being imposed through sanctions or rewards. The practitioner can accomplish this by supporting the three basic psychological needs of participants, in ways that will be outlined below.

Hence, from an SDT perspective, learning can be supported in three basic ways (see also Ryan and Deci 2017): 1) support intrinsic motivation and the development of intrinsic tendencies, 2) facilitate the integration of important values and social struc- tures, and 3) support functionally important outcomes that are associated with auton- omous behavior, such as vitality and well-being. It is worth noting that, although SDT has been used to empirically examine practice in other types of outdoor education, such as adventure project work (John et al. 2013), outdoor science teaching (Dettweiler et al. 2015) and outdoor adventure courses (Wang et al. 2004), it has not to date been used in relation to FS.

Forest school

FS is a specific form of outdoor learning which can be distinguished from other outdoor learning initiatives. Although FS sits underneath the greater umbrella of outdoor education, it has been described as a Bspecialised learning approach^(Forest School Association n.d.). Where other outdoor learning programmes can be bound by standardised curriculum goals, FS is predominantly child-led, with curriculum negoti- ated between adults and children. It is an approach that can be suitable for learners of all ages, but one which is overwhelmingly used with younger children (Knight 2011). It has the express aim of helping people –

predominantly younger children – grow as individuals, develop skills and confidence, as well as healthy relationships amongst themselves and with the environments they live in, especially focusing on more natural environments.

FS has been inspired by a Scandinavian approach to early years' education, which has a strong focus on the importance of 'place' for learning. The Danish udeskole (Bentsen and Jensen 2012) approach is deeply ingrained in decades of practice within a very established early years' ethos (Williams-Siegfredsen 2017). In the UK this approach has been named Forest School, with the Forest School Association (FSA) set up in 2011 to support those involved. Since this time the FS name and pedagogy have spread internationally, with the Irish Forest School Association (IFSA) founded in 2016 (Forest School Association n.d.; IFSA 2016) and FS settings evolving in countries as diverse as Portugal, South Africa, Brazil, Slovenia, India and Italy(Knight 2013b).

FS pedagogy has sometimes been linked with a 'constructivist' pedagogy (Harris 2017; Leather 2018; O'Brien 2009). Constructivism is, at its core, a Bmeaning making theory^(Richardson 2003, p. 3). As such, within constructivist educational theories,

children create meaning via their interactions with others around them, including other children and adults, as well as the local environment. Seeing learners as co-constructors and not as mere receivers of knowledge is central to the FS approach.

FS pedagogy comes with deep roots in other educational theories too (Doyle and Milchem 2012; Waite et al. 2016). These include Froebel's ideas emphasizing freedom and play (Liebschner 2002), Dewey's philosophy of 'real learning' and learning through life situations (Ord and Leather 2011), and Steiner's awareness of the natural environment as a facilitator of experiential learning (Steiner 1996). Through these deep traditions emerges a pedagogy that is child-centered, flexible and allows learners a freedom to control their own learning experiences, largely through playand explora- tion. All this happens within a local natural environment, preferably a forest.

It should be noted that FS is a vehicle for curriculum and not a curriculum in itself (Maynard 2007). Tensions can exist in some cases when the curricular goals and philosophy do not fully align with the ethos of FS (Waite and Davis 2007), but in this article we focus on an Bideal^ FS practice as presented in the literature, rather than the various ways in which it is adapted and enacted. Weacknowledge that the reality of FS, especially in the instances where it is used as a vehicle for curricular goals, may be different than the ideal representation. This is something that offers opportunities for

research, as we further develop below.

Essentially, what distinguishes FS from other types of outdoor learning is its unique purpose. The purpose of FS, as described by Waite et al. (2016), can be seen as two- fold. On the one hand, FS is a way to increase children's connections with nature, within the cultural and social context of an ever-urbanized and indoor society (Davis and Waite 2005). On the other hand, FS aims to increase young children's motivation to learn (Kenny 2010; Waite et al. 2016), mainly by stimulating their interests. To these two ends we wish to offer an SDT framework within which FS practice can be examined and enhanced. We note that, while the framework we are advancing is based on an ideal FS practice, drawing mostly upon UK literature, there will inevitably be intersections with other forms of nature-based outdoor learning. Hence there is scope for the framework to be successfully utilized by other outdoor child- centered settings internationally.

Forest school and self determination theory

It is because FS aims to help children develop through self-initiated learning activities that SDT, as a motivational theory, is ideally suited for offering evidence-based guidelines for FS. According to SDT, the required support for children's motivation to learn is possible through the presence of the right environmental conditions, and the absence of social contexts that over- control, over-challenge or exclude (Deci and Ryan 2000). More specifically this is possible when the socializing agents are supportive of three basic psychological needs, namely autonomy, competence and relatedness. *Autonomy* literally means 'regulation by the self' and refers to acting with full volition and self-endorsement. *Competence* refers to the need of individuals to master and be effective within their environment. *Relatedness* is seen as associated with social belonging and building strong interpersonal relationships, as well as feeling accepted and connected to others. When the social environment is supportive of these three basic psychological needs, intrinsic motivation and organismic integration are facilitated. With regard to education, need-supportive teaching practices have been developed and applied in several educational contexts (Aelterman et al. 2013, 2014; Stroet et al. 2013, 2015), showing specific positive functional and educational outcomes.

We propose that these basic psychological needs align with the basic ele- ments of FS pedagogy, as these are described in the academic and practitioner literature (Knight 2011, 2013a; Waite et al. 2016), as well as in practitioner guidelines from the FSA (n.d.). Moreover, we argue that FS pedagogy is well placed to support all three needs, unlike other indoor or

outdoor education settings, as outlined below. This is important, as Bsatisfaction of different basic psycho- logical needs often seems to be synergistic or mutually supportive^ (Ryan and Moller 2016, p. 228). This proposal constitutes a new organising framework to support pedagogical practice, addressing what Leather (2018) identifies as the Bundertheorised^ (p. 5) nature of FS pedagogy.

Autonomy

Within FS practice the participant is Bentitled to choose, and to initiate and drive their own learning and development^(FSA n.d.). This strong sense of self-authorship within FS practice aligns well with SDT's construct of autonomy. Exploring the idea that learners are able to choose activities that they find interesting and engaging is the embodiment of autonomous, self- authored behavior. Autonomy for SDT retains its primary etymological significance as Brule by the self^ and is distinguished from independence (Ryan and Deci 2006). It is not simply conceptualized as negative freedom, that is freedom from external interference, but especially as positive freedom, that is actively making meaningful choices (Arvanitis and Kalliris 2017). The focus is on the functional and experiential properties of choice, which lie along the autonomy continuum of intrinsic, integrated, identified, introjected and external regulation that have been presentedabove.

Offering choice

The opportunity to explore one's own surroundings and to make sense of them is given priority in the FS setting (Doyle and Milchem 2012; Harris 2017). This exploration is facilitated by FS leaders, whose work could rest upon the principles of autonomy-supportive teaching, suchasproviding meaningful options(Mouratidis etal. 2011), providing a rationale behind each activity and relating it to personal interests or learning goals (Assor et al. 2002).

Freely choosing an activity has an impact on whether children feel they are playing or working (McInnes et al. 2009, McInnes et al. 2011). Namely, when children have choice in an activity, they perceive it as play, regardless of setting (King and Howard 2014). It should be noted that in a FS context, this choice could be of the activity itself, or choice *within* an activity that has been set by the practitioner. Importantly, freedom to choose is not a binary concept. King and Howard (2016) present the idea of a choice continuum based on SDT, in relation to children's play. They note that complete freedom is often not possible, due to environmental, societal and other restrictions and therefore, adaptable choice is presented as a more appropriate model for use by practi- tioners. Adaptablechoicebalancesthepracticalneed forsomecontrol bythe adult (time, space, resources) and the need for choice by the child. Moreover, elements of commu- nication, discussed below, are important in the perception of an activity as play by children (Swann and Pittman 1977).

Communication

Adult-child communication canbeautonomy supportiveor thwarting. Language that is inquisitive, and not directive, and that acknowledges children's interests can support autonomy in the forest (Stefanou et al. 2004). This type of discourse is evident in some of the FS literature and centers around elicitation and open-ended questioning to further interest and deepen understanding (Doyle and Milchem 2012). At the same time, there is specific research within SDT on the properties of meaningful, autonomy-supportive dialogue, which can be incorporated harmoniously within FS practice. More specifically, for dialogue to be meaningful it needs to

tap into the child's interests, take an empathic view, provide choice and minimise control (Kaplan and Assor 2012). Reeve and Jang (2006) found that several instructional behaviors correlated positively with feelings of autonomy for the students, including listening, encouraging effort, and acknowledging the students' perspective. Moreover, offering hints, rather than solutions, as well as giving time for independent thinking to take place, can further support autonomy.

In order to facilitate effective communication, especially with young children whose verbal communication skills are still developing, effective practitioners can engage in the simple act of observation. They can focus on getting to know the child, through close observation on a daily basis (Côté-Lecaldare et al. 2016). The aim of such observational practices links with the aforementioned facilitation of dialogue, in that the adult needs to be able to acknowledge the child's internal frame of reference, in order to be empathic and able to take the child's perspective (Grolnick et al. 1997; Kaplan and Assor 2012; Reeve and Jang 2006).

Affordance of nature

Although research on autonomy supportive behaviors, so far, has been specific to indoor classroom environments and other traditional educational settings, there are some characteristic behaviors that are transferable and can enrich outdoor learning, and promote autonomy amongst participants. Reeve (2006) empha- sises the element of affordances as one that promotes autonomy. Affordance, as a concept within education, refers to the properties of an environment, which in relation to the child's abilities can enhance learning potential. Essentially, affordance refers to the functional utility of an object/environment to a specific person/animal. It is the way that the environment complements the competences and abilities of an organism (Gibson 1979), in this instance, the child.

In the work of Fjørtoft (2001) the term is explored in relation to outdoor play environments for children. Fjørtoft writes of the landscape as a dynamic and open- ended resource for children to engage with in a variety of ways. Affordance as a central part of FS has been explored by other researchers, who make the link between pedagogy and a host of open-ended opportunities to engage with nature in the forest (Sharma-Brymer et al. 2018). This idea of open-endedness is extremely inviting for children and can be used by the expert practitioner to underpin autonomy support in young learners. The forest is essentially a resource of rich, individualized opportunities for children to act in accordance with their innate capabilities and tendencies.

Competence

Competence, a basic psychological need, and motivation are closelylinked within SDT. It is rather telling of the interrelation of the two needs, that theoretical work prior to a fully articulated SDT considered autonomy and competence a single need (Deci 1975). The two are mutually supportive and in certain ways reciprocal (Ryan and Moller 2016). A salient point within the idea of experiencing competence, is that satisfaction derived from it is not necessarily at a level of absolute achievement, but rather more

central to the person's feelings of Bincreased mastery and effectance^ (Adams et al. 2017, p. 47). The FSA in the UK sees the participant as Bcompetent to explore and discover^ and Bentitled to experience appropriate

risk and challenge^ (Forest School Association n.d.). Challenge is also an inherent part of the Scandinavian FS approach (Williams-Siegfredsen 2017). By placing an emphasis on challenge, FS aims to nurture children's awareness of risk, at the same time as helping them develop the skills to tackle appropriate challenges.

Optimal challenge

In a study of risk and challenge in outdoor learning environments, Gill (2010) proposes a spectral model of risk and adventure. One end is play, as activity that is well within a participant's capacity; the other end is misadventure, where the participant's capacity and skill are overstretched, possibly leading to the occurrence of serious accidents, often with grave consequences. Between is an optimal challenge level where participant skill and challenge are well matched. The idea of 'optimal challenge' as the nexus of participant skill and activity level is also echoed in SDT. The importance of activities that are optimally challenging, and that allow students to both test and extend their skills is recognized both in education in general (Guay et al. 2008) and in the more specific context of physical education (Teixeira et al. 2012).

FS pedagogy sees the taking of appropriate risks as conducive to the process of healthy physical and emotional development (O'Brien 2009). Emotional resilience and social skills are both functional outcomes of children being able to undertake activities that are appropriately challenging (Waite et al. 2016). Additionally, many of these activities support enhancement of motor skills (Ord and Leather 2011). Risk taking in this setting is linked to gradually increasing levels of skill, with scaffolding, aimed at the development of both fine motor skills, in the case of tool use, and gross motor skills, in the case of climbing and balancing (Leather 2018). One of the ways that practitioners mitigate excessive risk is that inherently risky activities, such as tool use for fire lighting, are supported by appropriate adult involvement, inclusive of an adoption of different levels of progression for participants, according to their skills (Swarbrick et al. 2004; Leather 2018). The gradual and safe progression of skill use is supported through regular visits to the same task. Swarbrick et al. (2004) explore the idea of the challenge of the unfamiliar^ and how reiteration of a skill, or even repeat visits to the same environment, can facilitate this progression. Looking at this through an SDT lens, feelings ofcompetence, vital to the building of intrinsic motivation and well-being, are nurtured by the frequent visits to the same natural setting, and the building of skills relevant to that setting.

Feedback

Within SDT, positive feedback is seen as an informational event that has functionalsignificance for motivational processes. Providingpositive feedback, relative to negative feedback, can facilitate intrinsic motivation (Vallerand and Reid 1984). However, practitioners should be aware that positive feedback in the form of praise can actually undermine autonomously motivated behaviours. It is informational feedback that is the most useful type of feedback for intrinsic motivation, in that it can signify competence or can be useful in becoming more competent (Deci et al. 1982, 1999). Wording is also important. Feedback using the word 'should' has been found to diminish motivation, as it can be perceived as controlling (Ryan 1982). Practitioners can use alternative phraseology for informational feedback, that highlights one's ability to do something (e.g. 'you can also try with the saw') and highlights free choice.

Scaffolding learning and giving appropriatefeedback is anelementofacompetence supportive teaching practice (Aelterman et al. 2014; Jang et al. 2010; Sierens et al. 2009), but especially so within an early years context (Côté-Lecaldare et al. 2016). In relation to FS, an experienced leader scaffolds effectively, assesses the

level of mastery of participants, provides personalised incremental informational feedback and allows them to experiencea high degreeofautonomy in their attemptsat acquiring new skills.

Structure SDT frames the idea of competence and intrinsic motivation, within the broader context of structure. Structure, in this instance, refers to the extent to which a socializing agent, in our case the practitioner, provides consistent guidelines for behavior (Edmunds et al. 2008; Reeve et al. 2004). This is especially pertinent when working with young children (Grolnick and Pomerantz 2009). Creating structure in this manner, allows participants to be able to take risks, and stretch themselves into that optimal challenge zone, without overstretching into misadventure (Gill 2010). Limit- setting does not have to be controlling in nature, but can and should be informational, acknowledging the child's possibly conflicting feelings, yet clearly stating what the limits are (Koestner et al. 1984).

In an effective outdoor learning environment structure is central to experiencing acceptable risk and appropriate challenge (Ord and Leather 2011). Facilitating this process is provision of feedback that gives children a clear idea of the progress they are making within the expected standards (Koka and Hein 2005). This can be contrasted with chaotic settings, where structure is lacking and children may feel they are operating in a void. Skill building and feelings of competence are undermined in such instances (Skinner et al. 2005).

In order to create regulations that fully meet the participants' needs, skilled educators balance keeping them safe with allowing for reasonable risks to be taken and compe- tencies to be developed. It should be noted here that, within SDT, competence is intricately linked with autonomy – therefore, the satisfaction of both needs is crucial to intrinsic motivational processes(Ryan and Moller 2016). The forest is anideal environment for enabling autonomy and competence to be experienced and supported; always subject to a robust, yet flexible structure, through the consistent use of routines and rules.

We reiterate that our argument is founded on an idealised version of FS practice, and that the discrepancies between rhetoric and actual practice are acknowledged in the FS literature (Waite and Davis 2007). This is not a challenge unique to FS, but inherent in many educational settings. We suggest that the outlined structure has the above characteristics – i.e., informational, consistent, non-controlling and with the provision of adequate feedback – in order to be need-supportive.

Relatedness

The need of relatedness is satisfied when a person has a positive sense of connectedness with others, including the element of caring for others and being cared for (Deci et al. 2013). Within educational settings, relatedness is associated with a student feeling liked, valued, and accepted by the teacher. The academic literature on FS supports the view that building of interpersonal skills and positive relations constitute a desired outcome of participation (Borradaile 2006; Davis and Waite 2005; O'Brien 2009). Further, two of the seven ways in which FS characterizes participants, as viewed by the FSA, are linked to relationships. One states that the participant is entitled to develop positive relationships with themselves and other people^ (Forest School Association n.d.). The other is that the participant is Bentitled to develop a strong, positive relationship with the natural world^ (Forest School Association n.d.). This suggests that there are grounds for applying the

concept of relatedness, as a need conceptualized within SDT, in a FS setting.

Social relatedness

Personal relationships are at the core of education, and especially early years' education (Pianta and Stuhlman 2004). Relationship building is also at the heart of FS pedagogy (Harris 2017) and is one of the intended outcomes of FS (Waite et al. 2016). These relationships are key to the learning process and involve multiple layers of interaction. On a first level, there is the interaction of the practitioner with the learners. Here, communication is important for the support of autonomy and compe- tence; guidance has been given above as to how to successfully foster these two basic psychological needs. Tosupport relatedness, discourse has to show genuine interest for what the learners have to say, valuing and respecting their interests and listening in a way that facilitates the building of authentic connection and involvement (Deci et al. 1994; Skinner and Belmont 1993). This process of involvement, whereby an educator conveys warmth towards the students, facilitates the satisfaction of the need for relatedness and is associated with optimal motivation (Skinner and Belmont 1993).

On a second level, there is the interaction amongst participants. Participant relation- ships are a facilitator of the social and emotional development ofeach personinvolved. Social skills are developed through teamwork, turn taking, mutual respect and cooper- ation (Harris 2017). The desired effect of this socialization process is the feeling of relatedness towards one another, that is, on an interpersonal level but also in the sense of belonging to a social group (Osterman 2000).

Nature relatedness

While interpersonal relatedness is at the core of all educational settings (Ryan and Powelson 1991), both indoors and outdoors, there is a special aspect of outdoor education that cannot easily be replicated in the classroom. Outdoor learning in natural environments, such as FS, can support the building of a relationship between the individual and nature, in ways that are not as accessible in traditional educational settings. This development of Nature Relatedness (NR) is a positive and desired outcome for all. Not only is it linked with general psychological well-being, as well as subjective well-being (Nisbet et al. 2011; Zelenski and Nisbet 2014), but it also relates to environmental concern and pro-environmental behaviors (Nisbet et al. 2009). NR is also associated with a greater sense of belonging within a social context, creating a virtuous cycle between socialconnections and nature connections (Weinstein et al. 2009, 2015).

Pathways to NR have been studied in adults. Lumber et al. (2017) found that it is not mere knowing of nature that facilitates connectedness. Pathways to improve NR involve sustained contact, emotion and compassion towards nature, as well as appre- ciation ofbeauty. The same authorsargue that these areratherdifferent to the traditional routes used in education, which usually involve identification of plant and animal species and aknowledge-based curriculum. Such aesthetic and affectiveexperiences, it has been argued by Quay (2013), can shape our understanding of ourselves within nature, and encompass not only activities, but a distinct way of being in relation to nature. Once more, FS facilitates such ways to nurture a meaningful relationship with the natural world, as an integral part of its practice is reflection on the emotional journey that has been undertaken (Knight 2011).

An interesting reinforcing mechanism could further be developed by the skilful practitioner, using the SDT idea of integration. In the context of outdoor learning, when learners feel fulfilment of the need for relatedness towards the practitioner and the group, they are more likely to integrate the values of that group,

which are pointing strongly towards environmentally-friendly and sustainable behaviors in nature. Both close contact with nature and nature connectedness facilitate the development of such attitudes towards the environment (Cosgriff 2011; Lugg 2007).

This idea of promoting NR, through effective need-supportive learning experiences can be a goal of all outdoor learning pedagogies. The potential impact on personal well- being, social relationships and pro-environmental attitudes and behaviors is one way to affect positive change with regard to environmental outcomes. The aim of FS (n.d.) to support development of a relationship between the learner and the natural world could be instrumental in creating more sensitized and pro-environmental citizens.

Optimal internalization

Creating a learning context where the three basic psychological needs are met – for autonomy, competence and relatedness – will help children flourish. On the one hand, such a learning context supports intrinsic motivation. On the other hand, it supports the full development of the process of internalization, leading to integrated regulation with regard not only to learning objectives, but also to important values and normswithin this social context, and to positive functional outcomes. FS can both nurture intrinsic tendencies through fun child-led activities and also help in the optimal internalization of values and norms that may not offer enjoyment in themselves. This is an important desired outcome of FS participation (Waite et al. 2016). Deci et al. (1994) describe three contextual events that promote the process of integration: 1) providing a meaningful rationale, 2) acknowledging the student's perspective, and 3) providing choice. A host of empirical evidence further extends how giving value to a behavior through communicating a strong sense of empathic understanding and providing meaningful reasoning both facilitate internalization (Vansteenkiste et al. 2018). Linking reasoning to something of personal rele- vance to each participant also supports integrated regulation (Jang 2008). Finally, integration can be achieved through low levels of controlling behavior and providing choice or, more practically, through the use of inviting, rather than controlling language (Vansteenkiste et al. 2004). All of the above can be used by practitioners in a FS setting to promote integration of goals such as the advancement of positive social interactions, respect for the environment, as well as awareness of the natural world and sustainability.

Opportunities for future empirical research

The connections made in this article are all based on the application of SDT in the context of an ideal FS, as this is presented in the literature. As stated previously, we recognise that there may be some distance between ideal vs real practice, and suggest that one way of testing our argument would be through focused empirical research, especially since SDT is an empirically- based theory. As such, no assumptions should be made that cannot be tested through empirical means. Future empirical research should investigate need-supportive teaching practices within FS and other outdoor learning settings. This could be achieved with a combination of qualitative and quantitative methodologies to fully explore the depth and breadth of practitioner and learner interactions and how these can support student autonomy, competence and relatedness. Appropriate instruments have been developed to be used in such research, such as the Basic Psychological Need

Satisfaction and Frustration Scales (Chen et al. 2015) and the Problems in Schools (PIS) questionnaire (Deci et al. 1981). Similar studies have been undertaken in different contexts, for example traditional and constructivist classroom environments (Stroet et al. 2015), in physical education lessons (Aelterman et al. 2014) and in early childhood care settings (Côté-Lecaldare et al. 2016). The qualitative study conducted by Côté-Lecaldare et al. used interviews and content analysis to explore early childhood educators' conceptualizations of autonomy supportive practices within their particular settings. The Stroet et al. study cited above employed a narrative analysis of student-teacher interactions to establish positive and negative manifestations of need-supportive teaching in two different classroom environments. There is certainly scope for similar methodologies to be used within the non-traditional settings of FS programmes.

Research on risk and safety, in particular, when examined through an SDT perspective, could help create an empirical basis for the development of further understanding of the relations between safety, structure, risk and competence. Viewing risk and challenge as elements of a positive, growth inspiring process that fuels feelings of competence (when embraced within a stable and safe pedagogical structure), would be beneficial to FS practitioners. Further research could be more focused on the relationship between optimal challenge and perceived competence within a FS setting, as well as exploring the tensions between autonomy and structure, and ideal and enacted practice, as these are identified in previous FS literature (Waite and Davis2007).

Finally, looking more closely at the idea of NR and how this is promoted in outdoor learning settings would support further understanding of pedagogical practices that aim to improve outdoor and environmental education. Given the links between NR and concern for the environment (Nisbet et al. 2009), promoting NR within outdoor settings could give children a head start in developing appropriate pro-environmental attitudes and practices. There are instruments that have been validated for use with children aged between 8 and 12 (Bragg et al. 2013). Development of further methods appropriate for use with younger children, who make up the largest demographic of FS participants (Knight 2016), would be of benefit, facilitating further research endeavours.

Conclusion

In this article we argued for the application of SDT to further understand and enhance pedagogical practices within FS settings. We made explicit links between SDT and current FS practices, building a framework that holds the possibility of facilitating the growth of effective practices; practices that promote intrinsic motivation and positive functional outcomes for all learners. We believe that some of these recommendations will be appropriate for use by practitioners in outdoor settings other than FS, as there is overlap between pedagogies, locations and opportunities in other forms of outdoor learning. However, FS is particularly aligned, as it is predominantly child-led and can support not just one or two of the basic psychological needs but, as demonstrated above, all three. It is need satisfaction as a whole, and not in a piecemeal way, that is necessary for enhanced well-being, healthy devel- opment and motivation (Ryan and Deci 2000). We therefore hope that the bringing together of SDT and FS in such a framework can be of use to both researchers and practitioners in examining what effective outdoor learning looks like, and what it seeks to accomplish.

Compliance with ethical standards

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

References

Adams, N., Little, T. D., & Ryan, R. M. (2017). Self-Determination Theory. In M. L. Wehmeyer, K. A. Shogren, T. D. Little, & S. J. Lopez (Eds.), *Development of Self-Determination Through the Life-Course* (pp. 47–54). Dordrecht: Springer Netherlands. https://doi.org/10.1007/978-94-024-1042-6.

Aelterman, N., Vansteenkiste, M., Van Keer, H., De Meyer, J., Van den Berghe, L., & Haerens, L. (2013). Development and evaluation of a training on need- supportive teaching in physical education: Qualitative and quantitative findings. *Teaching and Teacher Education, 29*, 64–75. https://doi.org/10.1016/j. tate.2012.09.001.

Aelterman, N., Vansteenkiste, M., Van den Berghe, L., De Meyer, J., & Haerens, L. (2014). Fostering a need- supportive teaching style: Intervention effects on physical education teachers' beliefs and teaching behaviors. *Journal of Sport and Exercise Psychology, 36*(6), 595–609. https://doi.org/10.1123

/jsep.2013-0229.

Arvanitis, A. (2017). Autonomy and morality: A Self-Determination Theory discussion of ethics. *New Ideas in Psychology, 47*, 57–61. https://doi.org/10.1016/j.newideapsych.2017.06.001.

Arvanitis, A., & Kalliris, K. (2017). A self-determination theory account of self-authorship: Implications for law and public policy. *Philosophical Psychology, 30*(6), 763–783. https://doi.org/10.1080

/09515089.2017.1307333.

Assor, A., Kaplan, H., & Roth, G. (2002). Choice is good, but relevance is excellent: autonomy-enhancing and suppressing teacher behaviors predicting students' engagement in school work. *The British Journal of Educational Psychology, 72*(2), 261–278. https://doi.org/10.1348/000709902158883.

Bentsen, P., & Jensen, F. S. (2012). The nature of udeskole: Outdoor learning theory and practice in Danish schools. *Journal of Adventure Education & Outdoor Learning, 12*(3), 199–219.

Borradaile, L. (2006). *Forest School Scotland: An Evaluation Edinburgh: Forestry Commission Scotland.* http://circleoflifetraining.com/wordpress/wp- content/uploads/2018/01/Forest-School-final-report- Scotland-2006.pdf Accessed 27 August 2018.

Bragg, R., Wood, C., Barton, J., & Pretty, J. (2013). Measuring connection to nature in children aged 8–12: A robust methodology for the RSPB. *University of Essex* . https://www. rspb. org. uk/globalassets/downloads/documents/positions/education/measuring-connection-to-nature-in-children- aged-8%2D%2D-12%2D%2D-methodology.pdf Accessed July 2 2018.

Chen, B., Vansteenkiste, M., Beyers, W., Boone, L., Deci, E. L., Duriez, B., Lens, W., Matos, L., Mouratidis, A., Ryan, R. M., Sheldon, K. M., Soenens, B., Van Petegem, S., Van der Kaap-Deeder, J., & Verstuyf, J. (2015). Basic psychological need satisfaction, need frustration, and need strength across four cultures. *Motivation and Emotion, 39*, 216–236. https://doi.org/10.1007/s11031-014-9450-1.

Cosgriff, M. (2011). Learning from leisure: Developing nature connectedness in outdoor education. *Asia- Pacific Journal of Health, Sport and Physical Education, 2*(1), 51–65. https://doi.org/10.1080

/18377122.2011.9730343.

Côté-Lecaldare, M., Joussemet, M., & Dufour, S. (2016). How to support toddlers' autonomy: A qualitative study with child care educators. *Early Education and Development, 27*(6), 822–840. https://doi. org/10.1080/10409289.2016.1148482.

Davis, B., & Waite, S. (2005). Forest Schools: An evaluation of the opportunities and challenges in early years. Final Report. https://www.plymouth.ac.uk/uploads/production/document/path/6/6761/Forestschoofinalreport2.pdf Accessed 23 January 2018

Deci, E. L. (1975). *Intrinsic motivation*. New York: Plenum.

Deci, E. L., & Ryan, R. M. (2000). The" what" and" why" of goal pursuits: Human needs and the self- determination of behavior. *Psychological Inquiry, 11*(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01.

Deci, E. L., & Ryan, R. M. (2008). Facilitating optimal motivation and psychological well-being across life's domains. *Canadian Psychology/Psychologie Canadienne, 49*(1), 14.

Deci, E. L., Schwartz, A. J., Sheinman, L., & Ryan, R. M. (1981). An instrument to assess adults' orientations toward control versus autonomy with children: Reflections on intrinsic motivation and perceived com- petence. *Journal of Educational Psychology, 73*(5), 642–650. https://doi.org/10.1037/0022- 0663.73.5.642.

Deci, E. L., Spiegel, N. H., Ryan, R. M., Koestner, R., & Kauffman, M. (1982). Effects of performance standards on teaching styles: Behavior of controlling teachers. *Journal of Educational Psychology, 74*(6), 852. https://doi.org/10.1037/0022-0663.74.6.852.

Deci, E. L., Vallerand, R. J., Pelletier, L. G., & Ryan, R. M. (1991). Motivation and education: The self- determination perspective. *Educational Psychologist, 26*(3–4), 325–346. https://doi.org/10.1207/s15326985ep2603&4_6.

Deci, E. L., Eghrari, H., Patrick, B. C., & Leone, D. (1994). Facilitating internalization: The self-determination theory perspective. *Journal of Personality, 62*,119– 142.

Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological bulletin*, 125(6), 627. https://pdfs. semanticscholar.org/3374/fde0f00aa20810beaba27f1fe4bd54529dae.pdf Accessed 28 April 2018.

Deci, E. L., Ryan, R. M., & Guay, F. (2013). Self-determination theory and actualization of human potential. In D. McInerney, H. Marsh, R. Craven, & F. Guay (Eds.), *Theorydriving research: New wave perspectives on self processes and human development* (pp. 109– 133). Charlotte, NC: Information Age Press.

Dettweiler, U., Ünlü, A., Lauterbach, G., Becker, C., & Gschrey, B. (2015). Investigating the motivational behavior of pupils during outdoor science teaching within self-determination theory. *Frontiers in Psychology, 6*. https://doi.org/10.3389/fpsyg.2015.00125.

Doyle, J., & Milchem, K. (2012). *Developing a Forest School in early years provision*. London: Practical Pre- School Books.

Edmunds, J., Ntoumanis, N., & Duda, J. L. (2008). Testing a self-determination theory-based teaching style intervention in the exercise domain. *European Journal of Social Psychology, 38*(2), 375–388. https://doi. org/10.1002/ejsp.463.

Fjørtoft, I. (2001). The natural environment as a playground for children: The impact of outdoor play activities in pre-primary school children. *Early Childhood Education Journal, 29*(2), 111–117. http://www. imaginationplayground.com/images/content/3/0/3002/The-Natural-Environment-As-A-Playground-For-
Children-The-Impac.pdf Accessed 5 December 2017.

Forest School Association. (n.d.). What is forest school? http://www.forestschoolassociation.org/what-is- forest-school/ Accessed 25 January 2018. Gibson, J. (1979). *The ecological approach to visual perception*. Dallas: Houghton Mifflin.

Gill, T. (2010). *Nothing ventured: Balancing risks and benefits in the outdoors*: English Outdoor Council.

https://www.englishoutdoorcouncil.org/wp- content/uploads/Nothing-Ventured.pdf Accessed 14 December 2017.

Grolnick, W. S., & Pomerantz, E. M. (2009). Issues and challenges in studying parental control: Toward a new conceptualization. *Child Development Perspectives*, *3*(3), 165–170. https://doi.org/10.1111/j.1750- 8606.2009.00099.x.

Grolnick, W. S., & Ryan, R. M. (1987). Autonomy in children's learning: An experimental and individual difference investigation. *Journal of Personality and Social Psychology*, *52*(*5*), 890. https://doi. org/10.1037/0022-3514.52.5.890.

Grolnick, W. C., Deci, E. L., & Ryan, R. M. (1997). Internalization within the family: The self-determination theory perspective. In J. E. Grusec & L. Kuczynski (Eds.), *Parenting and children's internalization of values: A handbook of contemporary theory* (pp. 135–161). New-York: Wiley.

Guay, F., Ratelle, C. F., & Chanal, J. (2008). Optimal learning in optimal contexts: The role of self- determination in education. *Canadian Psychology*, *49*, 233–240. https://doi.org/10.1037/a0012758.

Hagger, M. S., & Chatzisarantis, N. L. (2007). The trans-contextual model of motivation. In M. S. Hagger &

N. L. D. Chatzisarantis (Eds.), *Intrinsic motivation and self-determination in exercise and sport* (pp. 53– 70). Champaign, IL: Human Kinetics.

Harris, F. (2017). The nature of learning at forest school: practitioners' perspectives. *Education 3–13*, *45*(2), 272–291. https://doi.org/10.1080/03004279.2015.1078833.

Jang, H. (2008). Supporting students' motivation, engagement, and learning during an uninteresting activity. *Journal of Educational Psychology*, *100*, 798–811 http://psycnet.apa.org/doi/10.1037/a0012841.

Jang, H., Reeve, J., & Deci, E. L. (2010). Engaging students in learning activities: It is not autonomy support or structure but autonomy support and structure. *Journal of Educational Psychology*, *102*(3), 588. https://doi.org/10.1037/a0019682.

John, S., Russell, M., John, W., Peter, A., Christine, N., & Shirley, G. (2013). Investigating the experience of outdoor and adventurous project work in an educational setting using a self-determination framework. *European Physical Education Review*, *19*(3), 315–328. https://doi.org/10.1177/1356336X13495629.

Kaplan, H., & Assor, A. (2012). Enhancing autonomy-supportive I–Thou dialogue in schools: Conceptualization and socio-emotional effects of an intervention program. *Social Psychology of Education*, *15*, 251–269. https://doi.org/10.1007/s11218-012-9178-2.

Kenny, R. (2010) Forest Schools and the Early Years Foundation Stage - An exploratory case study. http://www.academia.edu/666361/Forest_School_and_the_Early_Years_Foundation_Stage_An_ Exploratory_Case_Study Accessed 3 January 2018.

King, P., & Howard, J. (2014). Children's perceptions of choice in relation to their play at home, in the school playground and at the out-of-school club. *Children & Society*, *28*(2), 116–127. https://doi.org/10.1111/j.1099-0860.2012.00455.x.

King, P., & Howard, J. (2016). Free choice or adaptable choice: self-determination theory and play. *American Journal of Play*, *9*(1), 56. https://files.eric.ed.gov/fulltext/EJ1123860.pdf Accessed 29 April 2018

Knight, S. (2011). *Forest school for all*. London: Sage.

Knight, S. (2013a). *Forest school and outdoor learning in the early years*. London: Sage.

Knight, S. (Ed.). (2013b). *International perspectives on forest school: Natural spaces to play and learn*. London: Sage.

Knight, S. (2016). *Forest school in practice for all ages*. London: Sage.

Koestner, R., Ryan, R. M., Bernieri, F., & Holt, K. (1984). Setting limits on children's behavior: The differential effects of controlling vs. informational styles on intrinsic motivation and creativity. *Journal of Personality, 52*(3), 233–248. https://doi.org/10.1111/j.1467-6494.1984.tb00879.x.

Koka, A., & Hein, V.(2005). The effect of perceived teacher feedback on intrinsic motivation in physical education. *International Journal of Sport Psychology, 36*(2), 91.

Leather, M. (2018). A critique of BForest School^ or something lost in translation. *Journal of Outdoor and Environmental Education, 21*(1), 5–18. Liebschner, J. (2002). *A child's work: Freedom and play in Froebel's educational theory and practice.* Cambridge*:* Lutterworth Press.

Liu, W. C., Wang, J. C. K., & Ryan, R. M. (2015). *Building autonomous learners: Perspectives from research and practice using Self-Determination Theory*.
NewYork: Springer.

Lugg, A. (2007). Developing sustainability-literate citizens through outdoor learning: possibilities for outdoor education in Higher Education. *Journal of Adventure Education and Outdoor Learning, 7*(2), 97–112.

Lumber, R., Richardson, M., & Sheffield, D. (2017). Beyond knowing nature: Contact, emotion, compassion, meaning, and beauty are pathways to nature connection. *PLoS One, 12*(5) https://doi.org/10.1371/journal. pone.0177186.

Maynard, T. (2007). Forest Schools in Great Britain: An initial exploration. *Contemporary Issues in Early Childhood, 8(4)*, 320–331. https://doi.org/10.2304/ciec.2007.8.4.320.

McInnes, K., Howard, J., Miles, G. E., & Crowley, K. (2009). Behavioural differences exhibited by children when practising a task under formal and playful conditions. *Educational andChild Psychology, 26*(2).

McInnes, K., Howard, J., Miles, G., & Crowley, K. (2011). Differences in practitioners' understanding of play and how this influences pedagogy and children's perceptions of play. *Early Years, 31*(2), 121–133. https://doi.org/10.1080/09575146.2011.572870

Mouratidis, A., Vansteenkiste, M., Lens, W., & Sideridis, G. (2011). Variation in vitality and interest- enjoyment as a function of class-to-class need-supportive teaching and pupils' autonomous motivation. *Journal of Educational Psychology, 103*, 353–366 https://doi.org/10.1037/a0022773.

Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2009). The nature relatedness scale: Linking individuals' connection with nature to environmental concern and behavior. *Environment and Behavior, 41*(5), 715– 740. https://doi.org/10.1177/0013916508318748.

Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2011). Happiness is in our nature: Exploring nature relatedness as a contributor to subjective well-being.
Journal of Happiness Studies, 12(2), 303–322. https://doi.org/10.1007/s10902-010-9197-7.

Ng, J. Y., Ntoumanis, N., Thøgersen-Ntoumani, C., Deci, E. L., Ryan, R. M., Duda, J. L., & Williams, G. C. (2012). Self-determination theory applied to health contexts: A meta-analysis. *Perspectives on Psychological Science, 7*(4), 325–340. https://doi.org/10.1177/1745691612447309

O'Brien, L. (2009). Learning outdoors: The Forest School approach. *Education 3–13, 37*(1), 45–60. https://doi.org/10.1080/03004270802291798.

Ord, J., & Leather, M. (2011). The substance beneath the labels of experiential learning: The importance of John Dewey for outdoor educator s. *Australian Journal of Outdoor Education, 15*, 13.

Osterman, K. F. (2000). Students' need for belonging in the school community. *Review of Educational Research, 70*(3), 323–367. https://doi.org/10.3102/00346543070003323.

Perls, F. (1973). *The Gestalt approach & eye witness to therapy*. Palo Alto: Science & Behavior Books.

Pianta, R. C., & Stuhlman, M. W. (2004). Teacher-child relationships and children's success in the first years of school. School Psychology Review, 33(3), 444. http://pages.erau.edu/~andrewsa/Project_2/Christian_ John/DuneProject/Teaching.pdf Accessed 23 January 2018.

Quay, J. (2013). More than relations between self, others and nature: Outdoor education and aesthetic experience. *Journal of Adventure Education & Outdoor Learning, 13*(2), 142–157. https://doi. org/10.1080/14729679.2012.746846.

Reeve, J. (2002). Self-determination theory applied to educational settings. In E. L. Deci & R. M. Ryan (Eds.), *Handbook of self-determination research* (pp. 183–203). Rochester, NY: University of Rochester Press.

Reeve, J. (2006). Teachers as facilitators: What autonomy-supportive teachers do and why their students benefit. *The Elementary School Journal, 106*(3), 225–236.

Reeve, J., & Jang, H. (2006). What teachers say and do to support students' autonomy during a learning activity. *Journal of Educational Psychology, 98*, 209–218 http://psycnet.apa.org/doi/10.1037/0022- 0663.98.1.209.

Reeve, J., Jang, H., Carrell, D., Jeon, S., & Barch, J. (2004). Enhancing students' engagement by increasing teachers' autonomy support. *Motivation and Emotion, 28*(2), 147–169.

Richardson, V. (2003). *Constructivist teaching and teacher education: Theory and practice*. London: Routledge Falmer.

Ryan, R. M. (1982). Control and information in the intrapersonal sphere: An extension of cognitive evaluation theory. *Journal of Personality and Social Psychology, 43*(3), 450 http://psycnet.apa.org/doi/10.1037

/0022-3514.43.3.450.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68. https://doi.org/10.1037/0003-066 X.55.1.68.

Ryan, R. M., & Deci, E. L. (2006). Self-regulation and the problem of human autonomy: Does psychology need choice, self-determination, and will? *Journal of Personality, 74*(6), 1557–1586. https://doi. org/10.1111/j.1467-6494.2006.00420.x.

Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. New York: Guilford Publications.

Ryan, R. M., & Moller, A. C. (2016). Competence as a necessary but not sufficient condition for high quality motivation: A self-determination theory perspective. In A. Elliot, C. Dweck, & D. Yeager (Eds.), *Handbook of Competence Motivation* (2nd ed., pp. 214–231). New York: Plenum Press.

Ryan, R. M., & Powelson, C. L. (1991). Autonomy and relatedness as fundamental to motivation and education. *The Journal of Experimental Education, 60*(1), 49–66

Sharma-Brymer, V., Brymer, E., Gray, T., & Davids, K. (2018). Affordances guiding Forest School practice: the application of the ecological dynamics approach.
Journal of Outdoor and Environmental Education, *21*(1), 103–115.

Sierens, E., Vansteenkiste, M., Goossens, L., Soenens, B., & Dochy, F. (2009). The synergistic relationship of perceived autonomy support and structure in the prediction of self-regulated learning. *British Journal of Educational Psychology*, *79*(1), 57–68. https://doi.org/10.1348/000709908X304398.

Skinner, E. A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year.
Journal of Educational Psychology, *85*, 571–581 https://doi.org/10.1037/0022-0663.85.4.571.

Skinner, E., Johnson, S., & Snyder, T. (2005). Six dimensions of parenting: A motivational model. *Parenting: Science and Practice*, *5*(2), 175–235 https://doi.org/10.1207/s15327922par0502_3.

Stefanou, C. R., Perencevich, K. C., DiCintio, M., & Turner, J. C. (2004). Supporting autonomy in the classroom: Ways teachers encourage student decision making and ownership. *Educational Psychologist*, *39*(2), 97–110. https://doi.org/10.1207/s15326985ep3902_2.

Steiner, R. (1996). *The education of the child and early lectures on education.* Harnden: Steiner Books.

Stroet, K., Opdenakker, M.-C., & Minnaert, A. (2013). Effects of need supportive teaching on early adolescents' motivation and engagement: A review of the literature. *Educational Research Review*, *9*, 65–87. https://doi.org/10.1016/j.edurev.2012.11.003.

Stroet, K., Opdenakker, M.-C., & Minnaert, A. (2015). Need supportive teaching in practice: a narrative analysis in schools with contrasting educational approaches. *Social Psychology of Education*, *18*(3), 585– 613. https://doi.org/10.1007/s11218-015-9290-1.

Swann, W.B., & Pittman, T.S. (1977). Initiating play activity of children: The moderating influence of verbal cues on intrinsic motivation. *Child Development*, *48*, 1128–1132. https://doi.org/10.1111/j.1467- 8624.1977.tb01281.x.

Swarbrick, N., Eastwood, G., & Tutton, K. (2004). Self-esteem and successful interaction as part of the Forest School project. *Support for Learning*, *19*(3), 142–146. httpsdoi.org/10.1111/j.0268-2141.2004.00337.x.

Teixeira, P.J., Carraça, E. V.,Markland, D. A., Silva, M. N., & Ryan, R. M. (2012). Exercise, physical activity, and self-determination theory: A systematic review. *Journal of Behavioral Nutrition and Physical Activity*, *9*, 78. https://doi.org/10.1186/1479-5868-9-78.

Vallerand, R. J., & Reid, G. (1984). On the causal effects of perceived competence on intrinsic motivation: A test of cognitive evaluation theory. *Journal of Sport Psychology*, *6*(1), 94–102.

Vansteenkiste, M., Simons, J., Lens, W., Sheldon, K. M., & Deci, E. L. (2004). Motivating learning, performance, and persistence: The synergistic role of intrinsic goals and autonomy-support. *Journal of Personality and Social Psychology*, *87*, 246–260.

Vansteenkiste, M., Aelterman, N., De Muynck, G. J., Haerens, L., Patall, E., & Reeve, J. (2018). Fostering personal meaning and self-relevance: A self- determination theory perspective on internalization. *The Journal of Experimental Education*, *86*(1), 30–49. https://doi.org/10.1080/00220973.2017.1381067.

Waite, S. & Davis, B. (2007) The contribution of free play and structured activities in Forest School to learning beyond cognition: an English case: Chapter in edited book, Ravn, B. & Kryger, N. (eds.) (2007) *Learning beyond Cognition*, Copenhagen: the Danish University of Education, pp. 257–27.

Waite, S., Bølling, M., & Bentsen, P.(2016). Comparing apples and pears?: a conceptual framework for understandingformsof outdoor learningthroughcomparison of English Forest Schools and Danishudeskole. *Environmental Education Research*, *22*(6), 868–892.

https://doi.org/10.1080/13504622.2015.1075193.

Wang, C. K. J., Ang, R. P., Teo-Koh, S. M., & Kahlid, A. (2004). Motivational predictors of young adolescents' participation in an outdoor adventure course: A self-determination theory approach. *Journal of Adventure Education & Outdoor Learning*, *4*(1), 57–65. https://doi.org/10.1080/14729670485200421.

Weinstein, N., Przybylski, A. K., & Ryan, R. M. (2009). Can nature make us more caring? Effects of immersion in nature on intrinsic aspirations and generosity. *Personality and Social Psychology Bulletin*, *35*(10), 1315–1329. https://doi.org/10.1177/0146167209341649.

Weinstein, N., Balmford, A., DeHaan, C. R., Gladwell, V., Bradbury, R. B., & Amano, T. (2015). Seeing community for the trees: The links among contact with natural environments, community cohesion, and crime. *BioScience*, *65*(12), 1141–1153. https://doi.org/10.1093/biosci/biv151.

Williams-Siegfredsen, J. (2017). *Understanding the Danish Forest School approach: Early years education in practice*. New York: Routledge.

Zelenski, J. M., & Nisbet, E. K. (2014). Happiness and feeling connected: The distinct role of nature relatedness. *Environment and Behavior*, *46*(1), 3–23. https://doi.org/10.1177/0013916512451901.

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Appendix ii

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The Case for Nature Connectedness as a Distinct Goal of Early Childhood Education

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ABSTRACT

The importance of young children learning about the natural environment has been recognised in policy and curricular frameworks around the world. Moreover, there has been a call for children to spend more time outdoors and to reconnect with nature. However, the distinct construct of nature connectedness has not been examined in detail in relation to early childhood education. This article aims to bring together environmental psychology literature and early years' policy in an attempt to make the case for nature connectedness becoming a distinct goal in early childhood curricular frameworks. Furthermore, it aims to highlight gaps in the research literature and offer clear directions for future research.

Keywords: nature Connectedness; young children; early childhood; curriculum; policy; outdoor learning

It is generally agreed that good quality early education can play an important role towards the optimal development of children (Pianta et al., 2016). The effects of good quality early education are not merely transitory, but can be seen long after that phase of life has finished and well into adult life (Barnett, 1998; Ramey et al., 2000; Reynolds and Ou, 2011). The effects in question include cognitive skills and academic achievement (Ramey et al., 2000), but also encompass aspects of psychological wellbeing, in this case defined as smaller likelihood of depressive symptoms (Reynolds and Ou, 2011).

These advances in our understanding of the effects of quality early education and care have informed both policy and practice in most developed countries. Early years' curricula and frameworks for early childhood are now shaped around children's developmental needs (Kostelnik, Soderman, Whiren & Rupiper, 2007). Moreover, many modern early years' frameworks, such as that of Australia (Australian Government, 2009) and Scotland (Scottish Government, 2008) tend to value wellbeing[1] as a distinct outcome of this educational phase.

The aim of this conceptual paper is to put forward and substantiate the thesis that nature connectedness should be seen as a worthwhile goal, and a possible distinct outcome in early years' education. Nature connectedness is the extent to which a person identifies themselves as being a part of nature, also defined as a "sense of oneness with the natural world" (Mayer and Frantz, 2004, p. 504). To this effect, it will first outline the construct of nature connectedness and its correlates. The aims of early years' education as they are currently articulated in several curricula, will be looked at in conjunction. The argument that nature connectedness is a positive characteristic for both the individual, but also society as a whole will be unfolded, with reference to the current state of the literature.

[1] For the purposes of this paper the author will use wellbeing in the broadest sense possible, as defined by Dodge, Daly, Huyton & Sanders, 2012). Their multi-faceted definition focuses on a state of equilibrium, or the ability to maintain a state of homestasis. This ability is dependent upon having the psychological, social and physical resources to meet life's challenges. When the term 'wellbeing' is used within the paper in different ways, this will be defined in the relevant section. This is necessary when referring to other studies that have used the same term to describe subtly different constructs.

Ways in which nature connectedness can be promoted in the early years will be explored and, finally, directions for future research in this area will be presented. The central themes of this paper are presented in the image below (figure 1). This paper should be of interest to policy makers and practitioners involved in early childhood education, as well as a useful addition to the existing literature in informing further research.

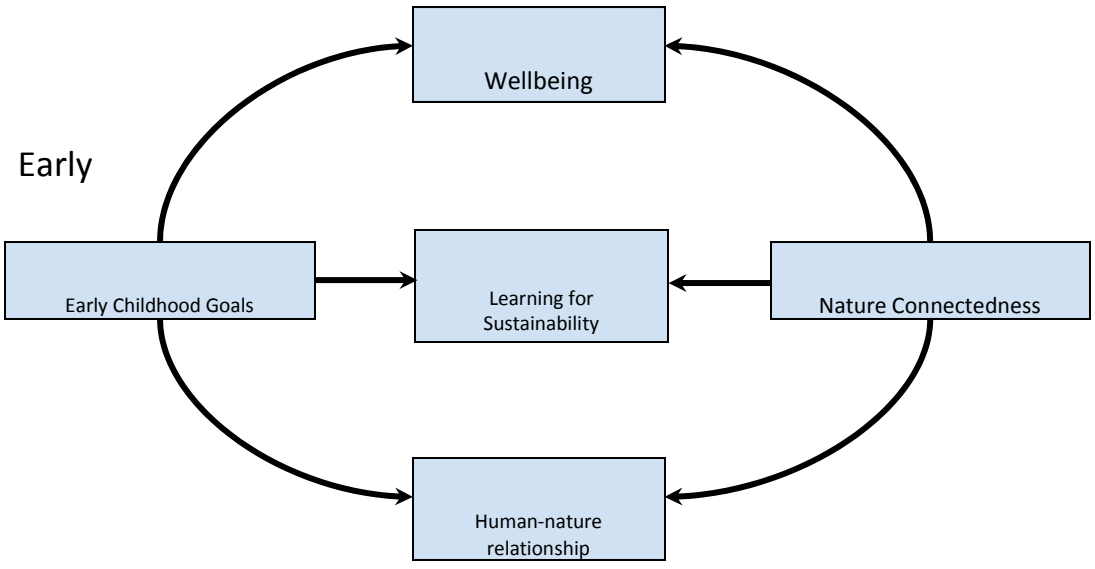

Figure 1. Relationship between Early Childhood Goals and Nature Connectedness.

Nature connectedness

Nature connectedness is the most common term used to describe a positive human-nature relationship. Other terms, such as Nature Relatedness (Nisbet et al, 2009) and Inclusion of Self in Nature (Martin and Czellar, 2016) have also been used and have largely similar characteristics. For the purposes of this article nature connectedness is the subjective perception of the self being a part of nature (Schultz, 2002). Nature connectedness as a construct has several elements, namely cognitive and affective strands (Mayer and Frantz, 2004; Schultz, 2002), as well as experiential and behavioural aspects (Nisbet et al., 2009). The cognitive strands mentioned above relate to the thoughts we have towards the environment (e.g. "I have a deep understanding of how my actions affect the natural world"), while the affective strands towards our feelings and emotions towards the natural world (e.g. "I often feel part of the web of life."; Mayer and Frantz, 2004). The experiential and behavioural aspects, particularly measured through the Nature Relatedness scale (Nisbet at al., 2009) are mostly referring to choosing to spend time outdoors (e.g. "I enjoy being outdoors, even in unpleasant weather" and "I enjoy digging in the earth and getting dirt on my hands.") and pro-environmental behaviours (e.g. "Nothing I do will change problems in other places on the planet[2]").

It should be noted that nature connectedness can be seen both as a personality trait (Kals, Schumacher & Montada, 1999), meaning that is largely stable across time, as well as a state (Mayer, Frantz, Bruehlman-Senecal & Dolliver, 2009), which can be changeable according to our experiences. In fact, positive experiences of nature, as well as learning experiences outdoors, have been found to increase nature connectedness in a host of studies (Barrable & Lakin, under review; Lumber, Richardson & Sheffield, 2017; Mayer et al., 2009; Vining, Merrick & Price, 2008). The kind of experiences that promote nature connectedness will be looked at in more detail in a separate section of the article.

Nature Connectedness and wellbeing

A host of empirical studies strongly suggest that simply being in contact with natural environments[3] is good for both our mental wellbeing (Grinde & Patil, 2009; Russel et al., 2013) and our physical health (Health Council of the Netherlands, 2008; Mitchell & Popham, 2008). Specific research on the benefits of nature contact for children has outlined green and other natural areas as "essential elements of healthy communities for children" (Chawla, 2015,
p. 433). A recent large longitudinal study from Scotland has found that access to natural space in the neighbourhood may reduce social, behavioural and emotional difficulties. This effect is stronger in children who have access to private gardens (Richardson, Pierce, Shortt & Mitchell, 2017). Moreover, positive cognitive effects have been observed after exposure to natural and green environments (Faber Taylor & Kuo, 2009), while other studies have discovered the restorative benefits of being in nature

(Hartig, Evans, Jamner, Davis & Gärling, 2003; Van den Berg, Hartig & Staats, 2007).

Feeling connected with nature has been found to be associated with more frequent visits to green spaces (Lin et al., 2014), therefore perhaps partially explaining what nature connectedness itself is correlated with increased wellbeing (Nisbet & Zelenski, 2014). However, the element of connection in itself should be highlighted as one of great importance in this relationship (Zelenski & Nisbet, 2014). Although it should be highlighted that all the evidence in the area of wellbeing and nature connectedness is correlational, with all the limitations this has, the relationship has been documented in several studies.

Wellbeing, as a psychological construct, is usually conceptualised in two separate but often interrelated dimensions: hedonic and eudaimonic wellbeing (McMahan & Estes, 2011). Hedonic wellbeing mainly relates to the experience of pleasure and the satisfaction of desires (Kahnemann, 1999), while eudaimonic wellbeing is mainly focused on the 'good life' in the Aristotelian sense, and the finding of meaning in one's life (Ryff, 1995). A large meta- analysis of a total sample size of 8523 found that there was a positive correlation between positive affect and nature connectedness (r = .22) and life satisfaction (r = .17; Capaldi, Dopko & Zelenski, 2014). Vitality was also used as a measure of wellbeing in the above study, with a correlation of r=.24 with nature connectedness. It is worth noting that although this may look like a small correlation it is comparable to that of income and education level in relation to wellbeing (Capaldi et al., 2014).

A 2018 study in preschool children, the first of its kind, found that nature connectedness was positively associated with enhanced psychological functioning (Sobko, Jia and Brown, 2018). The study, which used a parental report measure, found increased connectedness to nature to positively correlate with improved prosocial behaviour, fewer behaviour and emotional difficulties. This study signals the beginning of more research into young children's connectedness to nature, its correlates and hopefully ways to promote such a relationship.

Nature Connectedness and Sustainability

Another positive construct related to nature connectedness is pro-environmental attitudes and behaviours (Nisbet et al., 2011). As environmental destruction and climate destabilisation are most likely to be central concerns for this and the next generation(Sundblad, Biel & Garling, 2007) environmental education is often seen as one of the key ways to enact behaviour change in respect to protecting the environment (Jacobson, Carlton & Devitt, 2012). However, knowledge alone is not enough to initiate the major behaviour changes that are needed and there is a notable gap between acknowledging environmental dangers and acting in a pro-environmental way (Kollmuss & Agyeman, 2010). This is where nature connectedness which comprises of cognitive, affective and behavioural elements (Schultz, 2002) could be seen as gateway to inspiring pro-environmental attitudes and behaviours in the next generation of citizens. Although research to date has not causally linked nature connectedness in early childhood with adult pro-environmental behaviours, there are

studies that have demonstrated a correlation in adults between nature connection and both concern for the environment and pro-environmental behaviours (Nisbet, Zelenski & Murphy, 2009). In general connection to nature has been seen as a driver of behaviour, linked to the deep motivation of feeling connected and part of a greater whole, or what Frantz and Mayer call the "we-ness" aspect (2013, p. 85). Finally, adult environmentalism has been shown to have its roots deep in childhood, and positive childhood experiences in nature (Wells & Lekies, 2006).

Early childhood as the time to start developing nature connectedness

It is generally accepted, and usually based on various evolutionary theories, including that of Biophilia (Kellert & Wilson, 1993), that humans have an innate predisposition to connecting with their natural environment. However, it was David Orr (1993) who first put forward the idea that there may exist a 'critical period' during which one's positive experiences in nature get translated into biophilic tendencies, and therefore precede a later positive relationship with the natural world.

If we were to look at nature connectedness as part of one's identity, related to an environmental identity we should keep in mind that the creation of someone's identity, for example a national or ethnic identity, can have roots in childhood, and environmental identity is no different. It is through our personal history and emotional attachment that we develop an 'environmental identity' (Clayton, 2003). This can then often be reinforced through societal, affective and historical affiliations. In a retrospective study, Tam (2013) found that adults with higher nature connectedness recalled spending greater amounts of time in nature during their childhood, than those with lower levels of nature connectedness. Another study of similar design found a correlation between childhood nature experiences, and adult environmentalism (Wells & Lekies, 2006). Both studies indicate that childhood could be an ideal time to start nurturing our connection to nature. Finally, Chawla (2009) further looks into the process of socialisation for care towards nature, in childhood and early adolescence, with childhood experiences playing a central role in later attitudes and behaviours. Evidence from an empirical study that looked at environmental education programme evaluations showed that sustained changes in nature connectedness, measured at a follow- up 4 weeks post intervention, were significantly higher in children aged nine and ten years old, than in older children or university students (Liefländer, Fröhlich, Bogner & Schultz, 2013). The researchers suggest that strengthening nature connectedness are more sustainable when made before the age of eleven. High quality longitudinal studies are needed to confirm this.

Current state of the early childhood policy around the world

The following section will examine current early years' policy in different English-speaking countries around the world, in an effort to make links with the literature on nature connectedness which was outlined above. This section has a two-fold aim: to highlight how there are existing early years' curricula in various countries which implicitly hint at human-nature relationships as a distinct goal, and at the same time to draw out other elements of these curricula that would be directly enriched by the inclusion of

nature connectedness as a distinct goal. These elements include wellbeing and sustainability.

Human-human relationships and human-nature relationships in the early years (EY)

Most early years' frameworks place human-human relationships at the centre of early childhood education and care. The Scottish government, in a supporting document for guidance to practitioners places great importance on the early attachment process, most notably with the primary caregiver(s) (Scottish Government, 2014). The document focuses on attachment between child and parent, but also highlights the role of the practitioner in building secure relationships. In the English framework, personal, social and emotional development, and the formation of positive relationships in this respect, consists of its own area of learning, central to the philosophy of the framework (Department for Education, 2017).

The "Practice of Relationships" has a significant role in *Play, Participation and Possibilities*, the early learning curriculum framework for Alberta, Canada (Makovichuk, Hewes, Lirette & Thomas, 2014, p. 11). And yet, although these relationships encompass the relationships between the educator, the child and the family, a meaningful relationship with the environment is not articulated. Current policy in these countries focuses on nurturing human- human relationship, but not on the human-nature relationship.

The Australian Early Years Learning Framework moves closer to identifying a relationship with nature as a worthwhile outcome in itself (Australian Government, 2009). It puts an emphasis on a greater connection with the whole planet when it presents "Children are connected with and contribute to their world" (Australian Government, 2009, p. 28) as one of the outcomes of the framework. Moreover, this particular framework identifies a connection and respect for nature as a worthwhile goal as "children become socially responsible and show respect for the environment" (p. 32). Finally, *Belonging, Being and Becoming* clearly identifies a "connectedness to the land" (p. 32) in the context of different community protocols and interdependence of humans and the non-human world. In this sense, the Australian framework exemplifies the importance of nature connectedness as a worthwhile early years' outcome, although without explicitly articulating it as such.

Wellbeing in EY policy

The World Health Organisation (WHO) places emotional and social wellbeing as a responsibility of educational establishments (WHO, 2003), while UNICEF regularly collects and publishes data on children's wellbeing signalling the importance it places on the construct (Adamson, 2013; Fanzul, 2014; UNICEF, 2016).

Wellbeing is a common desired outcome in early childhood education and is often found in national early years' frameworks. It is explicitly stated in the Australian, Irish and Scottish frameworks (Australian Government, 2009; CECDE, 2006; Scottish Government, 2008), as well as that of Alberta and Nova Scotia in Canada (Makovichuk et al., 2014; Nova Scotia, 2018).

Education for Sustainable Development in the EY

Education for Sustainable Development has been promoted by UNESCO since 1992, and part of the Sustainable Development Goals (SDG) include both wellbeing at all ages, as well as protection of the natural environment in all its forms (UNESCO, 2017). In many ways, education has been seen by UNESCO as the ultimate vehicle to promote the SDG, but education systems and curricular frameworks have not necessarily been quick to respond to this call. The Scottish Government has set Learning for Sustainability as a priority for all sectors of education, and this is reflected on the Curriculum for Excellence, which underpins education from 3-18 (Scottish Government, 2008b).

Other countries, such as Australia have also included some aspects of sustainability education in their early years frameworks (Australian Government, 2009), while Nova Scotia, in Canada has included some aspect of environmental awareness and respect for the environment in its very recent curricular guidance titled Capable, Confident and Curious (Nova Scotia, 2018). Moreover, echoing the Australia early years' document it urges practitioners to "consider the nature of children's connectedness to the land and demonstrate respect for community protocols" (p. 81). Finally, sustainability as a concept is further mentioned as a worthwhile outcome in both of these frameworks (Australian Government, 2014; Nova Scotia, 2018).

Ways to promote nature connectedness in the early years

In this first part of this article, the point has been developed that nature connectedness is a useful and worthwhile goal for all education, but particularly suited to the holistic development of early years' frameworks. In the following second part of this article, we will explore ways in which nature connectedness can be promoted within an early years' setting, as well as examine some areas for further research into childhood experiences and nature connectedness.

Outdoor learning

As mentioned above contact with the natural world is one of the ways to nurture nature connectedness for all ages. Outdoor learning gives the opportunity for such sustained contact and meaningful engagement. The importance of outdoor learning is being recognised by education leaders and has become part of educational policy in England and Wales (DfES, 2006), and part of the Curriculum for Excellence in Scotland (Brown, 2010). National and regional curricula have introduced outdoor learning expectations in Australia (ACARA, n.d.), in New Brunswick, Canada (Department for Education, 2017), and Ireland (CECDE, 2006). Such developments have often sought to address the decline in outdoor play and learning opportunities for young people outside of formal education (Waite, 2010), as well as what has been named as Nature Deficit Disorder (Louv, 2008).

At the same time, outdoor early years education settings have seen a rise in the last decade in several countries around the globe. In Europe, and countries such as Germany, forest preschools (Waldkindergaarten) started in the 1960s, found approval in the 1990s, while today there are more than 1500 (BVNW, 2018). In Denmark more than 10% of preschools are in forests and other natural settings (Danish Ministry of Foreign Affairs, 2017). Different types of nature preschool practice have developed in countries such as South Africa, Portugal, Brazil, Slovenia, India and Italy (Knight, 2013). In the US nature-based preschools are a growing trend, with the rate of growth having greatly increased in the last 5 years. A Natural Start Alliance (NSA) national survey concluded that there are over 250 of them operating in 43 states (NSA, 2017). In Australia, Bush Kindergarten, adapted from European forest school to fit the climate and cultural identity of the country, has also become increasingly popular (Victoria Department of Education, n.d.; Campbell & Speldewinde, 2018).

However, while there is unprecedented growth in outdoor early childhood education and care settings, the frameworks that guide the outcomes for early childhood education are not always applicable to such nature-based establishments. It is, therefore, an aim of this article to encourage both policy makers and educators in nature- settings internationally to embed nature connectedness as an outcome of outdoor learning.

A pedagogy for connectedness

Although time spent in nature has been found to correlate with nature connectedness (Nisbet, Zelenski & Murphy, 2009; Sobel, 1996), further refining the ways that we engage with it can promote lasting changes in the way children relate to the natural environment. Knowledge-based curricula and environmental education programmes have been found to have an effect on nature connectedness (Barrable & Lakin, under review; Ernst & Theimer, 2011). However, other work has highlighted the affective side of our engagement with nature seems to be key in building life-long relationships with it. Kals, Schumacher and Montada (1999) outlined the process through which positive experiences in nature during childhood translate themselves into greater emotional affinity in adolescence and adulthood. Moreover, this is further linked with nature-protective behaviours. Breaking down this affective relationship with nature four aspects emerge: love, feelings of freedom when in nature, feeling secure when in natural environments and being part of or “oneness” with nature (Müller, Kals & Pansa, 2009; p. 60). It is this element of freedom, and child-led pedagogy that can be crucial in creating the positive experiences that will enhance children’s connection to nature. Moreover, supporting children’s autonomy when playing and learning in natural settings can lead to gains in overall wellbeing too (Barrable & Arvanitis, 2018). More recent studies looking at the pathways towards nature connectedness have attempted to further explore the roles of emotion. An empirical study into nature connectedness determined that beyond knowledge and mere contact, emotionally engaging with nature, as well as compassion, meaning and beauty are all pathways to nature connectedness in adults (Lumber, Richardson & Sheffield, 2017).

Future directions for nature connectedness in early childhood education

As seen above, the current state of the literature provides us with some idea of how a relationship to the natural environment develops through the life-span, with childhood being a crucial time for development (Müller, 2009; Wells & Lekies, 2006). It also provides us with a theoretical background of how nature connectedness can be nurtured in children (Kals et al., 1999), and features empirical studies, mostly performed on adults, on increasing nature connectedness through various activities (Lumber et al., 2017; Richardson, Cormack, McRobert & Underhill, 2016; Richardson & Sheffield, 2017; Tam, Lee & Chao, 2013). A summary of this research would bring together the following important points: 1) anthropomorphising nature could lead to increases in nature connection (Tam et al., 2013); 2) *noticing* beauty in the nature around us can enhance how connected we feel to it (Richardson et al., 2017) and 3) engaging with nature through emotion, compassion and empathy, as well as with nature's beauty can be pathways to nature connectedness (Lumber et al., 2017).

Although there is nothing to suggest that the above are not also pertinent to children too, there are also a few empirical studies that have focused specifically on children when it comes to increasing nature connectedness. A 2011 study that focused on fifth-grade students in the US found links between time spent outside and nature connection, and found that nature connectedness partially mediated the effect of time outdoors on environmental stewardship (Andrejewski, Mowen & Kerstetter, 2011). However, the types of activities the children engaged in were not looked at in detail.

This was indeed explored in a study of the educational programme Get to Know (Bruni, Winter, Schultz, Omoto & Tabanico, 2017). The Get to Know programme was designed to promote connection to nature through a variety of activities, of which only a subset were evaluated for the article. These included a creative arts competition, an outdoor nature trail treasure hunt and a virtual hike. Of the three interventions, only the creative arts competition showed a significant increase in nature connectedness after participation (Bruni et al., 2017). This is in line with some of the previous studies suggesting that engaging with nature's beauty, through artistic endeavours in this case, can promote feelings of connection. It is somewhat surprising to see that the outdoor trail did not promote changes in nature connectedness, as previous research in adults has indicated increases in nature connectedness after time spent outdoors, but the authors suggest that more time spent during the hike, or more frequent visits may well give different results. The above study was conducted in primary-age children, the youngest of which was 6 years of age. The point stands that what we, as practitioners might believe promotes nature connectedness may not besupported by the evidence. In this respect, more research isneeded.

The process and promotion of nature connectedness in early childhood has only been studied in two recent small studies, one a field report (Tsevreni & Tigka, 2018) and another an evaluation of an ongoing forest school programme (McCree, Cutting, & Sherwin, 2018). In the report, which is from a nursery in Greece, the role of the children as agents of establishing a human-nature relationship is emphasised, as opposed to a more official, adult- driven approach (Tsevreni & Tigka, 2018). This may link to previous theoretical suggestions by Müller et al. (2009) and Barrable and Arvanitis (2018) both

of which have supported a drive for freedom and autonomy in nature. The evaluation of the forest school programme was a longitudinal mixed methods project that tracked a small number of children (n=11), who were between five and seven years of age upon entry, across the duration of the programme, which lasted for three years (McCree et al., 2018). As at the time of the evaluation there was no scale for use with children of that age, the cohort were only measured upon finishing the programme, with no comparison data from the beginning. However, these nature connectedness scores were compared with matched peers from a local schools. The cohort's nature connectedness scores were significantly higher than those of matched peers who had not participated in forestschool.

It should be noted that in a systematic review of nature connectedness interventions (Barrable, in preparation) 26 studies were identified. Eleven of those had children as participants, but only one, reported above (McCree at al., 2018) had children younger than eight years of age participating. This may be attributed to the fact that a validated measure did not exist for this age group before 2018.

In conclusion of this section, there is certainly need for further empirical research on the types of experiences that nurture nature connectedness in children. One way of doing that would be through evaluations of nature programmes such as the one described above (McCree et al., 2018). Moreover, research that will focus on promoting the building of an *affective* relationship with the environment in early years' settings would provide valuable evidence with which to build a basis for pedagogical practice in early childhood settings around the world. One of the challenges that practitioners may face in incorporating nature connectedness as an outcome is difficulties in accurately measuring it, as an age-appropriate validate measure does not currently exist.

Measuring nature connectedness in children

A variety of validated instruments exist in order to measure nature connectedness in adults, such as the Nature Relatedness Scale (NR; Nisbet et al., 2009) the Nature in Self Scale (INS; Schultz, 2001) Connectedness to Nature Scale (CNS; Mayer & Frantz, 2014). All of these scales were found to interrelate with each other to a high degree (Tam, 2013). A scale for use specifically in children was developed and validated by Cheng and Monroe (2012) and was named the Connection to Nature Index (CNI).

The other scales mentioned above were initially designed for use with adults, but two of them have since been adapted for use with children, aged 8-12 (Bragg, Wood, Barton & Pretty 2013). These comprise the short-form NR scale (NR-6; Nisbet et al., 2009; 2011) and the single-item INS (Schultz, 2001). Of these measures, both the NR and CNI scales showed good internal consistency and there was a correlation between all three measures. The CNI was found to be the most preferred measure, by the children who took part in the study (Bragg et al., 2013). These measures have since been used in several studies evaluating outdoor learning and other environmental education programmes (Crawford, Holder & O'Connor, 2017; Razani et al., 2016; San Jose & Nelson, 2017).

Sobko, Jia and Brown (2018), acknowledging the need for measuring nature connectedness in young children devised a parental report measure, based on the CNI (Cheng & Monroe, 2012). The measure, termed CNI-PPC was tested for both internal consistency (n= 299) and external validity (n=194). It was, moreover, compared with the Strengths and Difficulties Questionnaire (SDQ; Goodman, Meltzer & Bailey, 1998) to measure convergent and divergent validity. The CNI PPC was found to be a valid and reliable measure for nature connectedness in preschool children. Its use in further research will shed light on the processes through which children's nature connectedness can be nurtured, as well as further associations of nature connectedness in early childhood.

Conclusion

Several decades ago, in the UNESCO declaration of Tbilisi highlighted the role of education in solving environmental problems (UNESCO, 1978). Environmental education that would focus on the learner's environmental sensitivity at "every age, but with special emphasis on environmental sensitivity to the learner's own community inearly years" (UNESCO, 1978, p 26) was stated as a goal. This, however, never came into fruition in relation to early years' policy in the following decades. Perhaps it is time that this is changed.

This paper has attempted to make the case for the inclusion of nature connectedness in early year curricula, as a distinct and valid goal. The author has outlined both the benefits of nature connectedness, as well as the ways in which nature connectedness aligns with current policy and curricular goals in several countries around the world. Moreover, this article brings together evidence on some of the ways that nature connectedness can be promoted in the early years. Finally, we have presented a clear direction for future research in relation to nature connectedness and early years. It is the author's hope that this article will bring attention to nature connectedness well beyond the usual scope of environmental education professionals and that it will be of use to educators, policy makers, as well as researchers in the field of early childhood.

REFERENCES

ACARA (n.d.) https://www.australiancurriculum.edu.au/resources/curriculum- connections/portfolios/outdoor-learning/ Accessed on 6 February 2018

Adamson, P., (2013). *Child Well-being in Rich Countries: A comparative overview, Innocenti Report Card no. 11* Accessed 11 August 2018 https://www.unicef-irc.org/publications/683-child-well-being-in- rich-countries- a-comparative-overview.html

Andrejewski, R., Mowen, A. J., & Kerstetter, D. L. (2011). An Examination of Children's Outdoor Time, Nature Connection, and Environmental Stewardship. *Proceedings of the Northeastern Recreation Research Symposium* Accessed August 2018 https://scholarworks.umass.edu/cgi/viewcontent.cgi?referer=https://www.google.co.uk/&httpsredir=1&article=1001&context=nerr

Australian Government (2009). *Belonging, Being & Becoming - The Early Years Learning Framework for Australia*

Accessed 15 August 2018 https://docs.education.gov.au/node/2632

Barrable, A., & Arvanitis, A. (2018). Flourishing in the forest: looking at Forest School through a self- determination theory lens. *Journal of Outdoor and Environmental Education*, 1-17.

Bragg, R., Wood, C., Barton, J., & Pretty, J. (2013). *Measuring connection to nature in children aged 8-12: A robust methodology for the RSPB*. University of Essex. Accessed 10 September 2018 https://www.rspb.org.uk/globalassets/downloads/documents/positions/education/measuring-connection-to-nature-in-children-aged-8---12---methodology.pdf

Brown, K. (2010). *Curriculum for excellence through outdoor learning*. Learning and Teaching Scotland. Bruni, C. M., Winter, P. L., Schultz, P. W., Omoto, A. M., & Tabanico, J. J. (2017). Getting to know nature:

evaluating the effects of the Get to Know Program on children's connectedness with nature. *Environmental Education Research*, 23(*1*), 43-62. https://doi.org/10.1080/13504622.2015.1074659 BVNW. (2018) *Federation for Nature and Nature Kindergartens in Germany*, 2018 http://bvnw.de/uber-uns/ Campbell, C., & Speldewinde, C. (2018). Bush kinder in Australia: A new learning 'place'and its effect on local

policy. *Policy Futures in Education*, 147

Capaldi, C. A., Dopko, R. L., & Zelenski, J. M. (2014). The relationship between nature connectedness and happiness: a meta-analysis. *Frontiers in Psychology*, 5, 976.

Centre for Early Childhood Development and Education (2006). *Síolta* Accessed August 2018 https://www.earlychildhoodireland.ie/work/quality-practice/national-frameworks/

Chawla, L. (2009). Growing up green: Becoming an agent of care for the natural world. *The Journal of*

Developmental Processes, 4(*1*), 6-23.

Cheng, J. C. H., & Monroe, M. C. (2012). Connection to nature: Children's affective attitude toward nature. *Environment and Behavior*, *44*(1), 31-49.

Chawla, L. (2015). Benefits of nature contact for children. *Journal of Planning Literature*, 30(*4*), 433-452.

Crawford, M. R., Holder, M. D., & O'Connor, B. P. (2017). Using mobile technology to engage children with nature. *Environment and Behavior*, *49*(9), 959-984.

Danish Ministry of Foreign Affairs. (2017) *Forest Preschools* http://denmark.dk/en/meet-the- danes/forest- preschools Accessed 12 July 2018

Department of Education and Early Childhood Development (2017) *Outdoor Education 110*, http://www2.gnb.ca/content/dam/gnb/Departments/ed/pdf/K12/curric/Health-PhysicalEducation/OutdoorEducation.pdf Accessed on 6 July 2018.

Department for Education (2017). *Statutory framework for the early years foundation stage* Accessed July 2018 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/596629/EYFS_STATUTORY_FRAMEWORK_2017.pdf

DfES (2006) *Learning Outside the Classroom Manifesto*, Department for Education and Skills http://www.lotc.org.uk/wp-content/uploads/2011/03/G1.-LOtC-Manifesto.pdf Accessed 6 December 2017

Dodge, R., Daly, A., Huyton, J., & Sanders, L. (2012). The challenge of defining wellbeing. *International Journal of Wellbeing, 2*(3), 222-235. doi:10.5502/ijw.v2i3.4

Ernst, J., & Theimer, S. (2011). Evaluating the effects of environmental education programming on connectedness to nature. *Environmental Education Research*, 17(*5*), 577-598. https://doi.org/10.1080/13504622.2011.565119

Faber Taylor, A., & Kuo, F. E. (2009). Children with attention deficits concentrate better after walk in the park. *Journal of Attention Disorders*, 12(*5*), 402-409.

Fanjul, G. (2014). *Children of the Recession: The impact of the economic crisis on child well-being in rich countries, Innocenti Report Card no. 12* Accessed August 2018 https://www.unicef-irc.org/publications/733-children- of-the-recession-the-impact-of-the-economic-crisis-on-child-well-being-in.html

Frantz, C. M., & Mayer, F. S. (2014). The importance of connection to nature in assessing environmental education programs. *Studies in Educational Evaluation*, 41, 85-89. doi:10.1016/j.stueduc.2013.10.001

Goodman, R., Meltzer, H., & Bailey, V. (1998). The Strengths and Difficulties Questionnaire: A pilot study on the validity of the self-report version. *European child & adolescent psychiatry*, *7*(3), 125-130.

Grinde, B., & Patil, G. G. (2009). Biophilia: does visual contact with nature impact on health and well-being?. *International journal of environmental research and public health*, 6(*9*), 2332-2343. https://dx.doi.org/10.3390%2Fijerph6092332

Hartig, T., Evans, G. W., Jamner, L. D., Davis, D. S., & Gärling, T. (2003). Tracking restoration in natural and urban field settings. Journal of environmental psychology, 23(2), 109-123.

https://doi.org/10.1016/S0272- 4944(02)00109-3

Health Council of the Netherlands Nature and Health (2004) T*he Influence of Nature on Social, Psychological and Physical Well-Being Health Council of the Netherlands and Dutch Advisory Council for Research on Spatial Planning*, Hague, Accessed August 2018 https://www.gezondheidsraad.nl/sites/default/files/pdf

Kahneman, D. (1999). "Objective happiness," in *Well-Being: The Foundations of Hedonic Psychology*, eds D. Kahneman, E. Diener, and N. Schwarz (New York, NY: Sage),

Kellert, S. R., and Wilson, E. O. (eds.). (1993). *The Biophilia Hypothesis*. Washington, DC: Island Press.

Knight, S. (Ed.). (2013). *International perspectives on forest school: Natural spaces to play and learn.*London: Sage

Kollmuss, A., & Agyeman, J. (2002). Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior?. *Environmental education research*, 8(3), 239-260. https://doi.org/10.1080/13504620220145401

Kostelnik, M. J., Soderman, A. K., Whiren, A. P., & Rupiper, M. L. (2007). *Developmentally Appropriate Curriculum: best Practices in Early Childhood Education* 4th. New Jersey: Pearson Prentice Hall.

Liefländer, A. K., Fröhlich, G., Bogner, F. X., & Schultz, P. W. (2013). Promoting connectedness with nature through environmental education. *Environmental Education Research, 19*(3), 370-384.

Lin, B. B., Fuller, R. A., Bush, R., Gaston, K. J. & Shanahan, D. F. (2014). Opportunity or orientation? Who uses urban parks and why. *PLOSOne*, 9(*1*), 1-7. doi:10.1371/journal.pone.0087422

Louv, R., (2008) *Last child in the woods: Saving our children from nature-deficit disorder*. New York: Algonquin books

Lumber, R., Richardson, M., & Sheffield, D. (2017). Beyond knowing nature: Contact, emotion, compassion, meaning, and beauty are pathways to nature connection. *PloS one*, 12(*5*), e0177186. https://doi.org/10.1371/journal.pone.0177186

Makovichuk, L., Hewes, J., Lirette, P., & Thomas, N. (2014). *Play, participation, and possibilities: An early learning and child care curriculum framework for Alberta*. Accessed August 2018 http://childcareframework.com/resources/Play,%20Participation,%20and%20Possibilities%20-%20An%20Early%20Learning%20and%20Child%20Care%20Curriculum%20Framework%20for%2 0Alberta.pdf

Martin, C., & Czellar, S. (2016). The extended Inclusion of Nature in Self scale. Journal of *Environmental Psychology, 47*,181-194.

Mausner, C. (1996). A kaleidoscope model: defining natural environments. *Journal of Environmental Psychology*, *16*(4),335-348.

Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology*, 24(*4*), 503-515.

Mayer, F. S., Frantz, C. M., Bruehlman-Senecal, E., & Dolliver, K. (2009). Why is nature beneficial? The role of connectedness to nature. *Environment and Behavior*, *41(*5), 607-643.

McCree, M., Cutting, R., & Sherwin, D. (2018). The Hare and the Tortoise go to Forest School: taking the scenic route to academic attainment via emotional wellbeing outdoors. *Early Child Development and Care, 188*(7),980-996.

McMahan, E. A., & Estes, D. (2011). Hedonic versus eudaimonic conceptions of well-being: Evidence of differential associations with self-reported well-being. *Social Indicators Research*, 103(*1*), 93-108.

Mitchell, R., & Popham, F. (2008). Effect of exposure to natural environment on health inequalities: an observational population study. *The Lancet*, 372(*9650*), 1655-1660.

Müller, M. M., Kals, E., & Pansa, R. (2009). Adolescents' emotional affinity toward nature: A cross-societal study. *Journal of Developmental Processes*, 4(*1*), 59-69.

Nisbet, E. K., & Zelenski, J. M. (2014). Nature Relatedness and Subjective Well-Being. *In Encyclopedia of Quality of Life and Well-Being Research* (pp. 4269-4276). Springer, Dordrecht. https://doi.org/10.1007/978-94-007-0753-5_3909

Nisbet, E. K., Zelenski, J. A., & Murphy, S. A. (2009). "The nature relatedness scale: Linking individuals' connection with nature to environmental concern and behaviour". *Environment and Behaviour*, 41, 715-740

Nova Scotia (2018) *Capable, Confident and Curious: NOVA SCOTIA'S EARLY LEARNING CURRICULUM FRAMEWORK*Accessed August 2018 https://www.ednet.ns.ca/docs/nselcurriculumframework.pdf

Orr, D. W. (1993). "Love it or lose it: the coming biophilia revolution," in *The Biophilia Hypothesis*, eds S. Kellert and E. O. Wilson (Washington, DC: Island Press), 415-440.

Razani, N., Kohn, M. A., Wells, N. M., Thompson, D., Flores, H. H., & Rutherford, G. W. (2016). Design and evaluation of a park prescription program for stress reduction and health promotion in low- income families: The Stay Healthy in Nature Everyday (SHINE) study protocol. *Contemporary Clinical Trials, 51*, 8-14.

Reynolds, A. J., & Ou, S. R. (2011). Paths of effects from preschool to adult well-being: A confirmatory analysis of the Child-Parent Center Program. *Child development, 82*(2), 555-582.

Richardson, M., Cormack, A., McRobert, L., & Underhill, R. (2016). 30 days wild: Development and evaluation of a large-scale nature engagement campaign to improve well-being. *PloS one*, 11(*2*), e0149777. https://doi.org/10.1371/journal.pone.0149777

Richardson, E. A., Pearce, J., Shortt, N. K., & Mitchell, R. (2017). The role of public and private natural space in children's social, emotional and behavioural development in Scotland: A longitudinal study. *Environmental Research, 158*, 729-736.

Richardson, M., & Sheffield, D. (2017). Three Good Things in Nature: Noticing nearby nature brings sustained increases in connection with nature/Tres cosas buenas de la naturaleza: prestar atención a la naturaleza cercana produce incrementos prolongados en conexión con la naturaleza. *Psyecology*, 8(*1*), 1-32.

Ryff, C. D. (1995). Psychological well-being in adult life. *Current Directions in Psychological Science*, 4(*4*), 99-104. https://doi.org/10.1111%2F1467-8721.ep10772395

San Jose, A. L., & Nelson, K. E. (2017). Increasing Children's Positive Connection to, Orientation toward, and Knowledge of Nature through Nature Camp Experiences. *International Journal of Environmental and Science Education*, *12*(5), 933-944.

Schultz, P. W. (2001). The structure of environmental concern: Concern for self, other people, and the biosphere.
Journal of Environmental Psychology, 21(*4*), 327-339.

Schultz, P. W. (2002). "*Inclusion with nature: The psychology of human-nature relations*". In P. W. Schmuck & W. P. Schultz (Eds.), *Psychology of sustainable development*. (pp. 62-78). Norwell, MA: Kluwer Academic.

Scottish Government (2008a). Early Years Framework Accessed August 2018 https://www.gov.scot/resource/doc/257007/0076309.pdf

Scottish Government (2008b). *Curriculum for Excellence: Building the curriculum 3* Accessed August 2018 https://www.gov.scot/resource/doc/226155/0061245.pdf

Sobel, D. (1996). *Beyond Ecophobia: Reclaiming the Heart of Nature Education.* Great Barrington, MA: The Orion Society.

Sobko, T., Jia, Z., & Brown, G. (2018). Measuring connectedness to nature in preschool children in an urban setting and its relation to psychological functioning. *PloS one*, *13*(11), e0207057.

Tam, K. P. (2013). Concepts and measures related to connection to nature: Similarities and differences. J*ournal of Environmental Psychology*, 34, 64-78. https://doi.org/10.1016/j.jenvp.2013.01.004

Tam, K. P., Lee, S. L., & Chao, M. M. (2013). Saving Mr. Nature: Anthropomorphism enhances connectedness to and protectiveness toward nature. *Journal of Experimental Social Psychology*, 49(*3*), 514-521. https://doi.org/10.1016/j.jesp.2013.02.001

Tsevreni, I., & Tigka, A. (2018). Young Children Claiming Their Connection with Nonhuman Nature in Their Schoolground. *Children, Youth and Environments*, 28(*1*), 119-127.

UNESCO. (1978). F*inal report: Intergovernmental conference on environmental education*. Paris: UNESCO. Accessed 13 September 2018 http://unesdoc.unesco.org/images/0003/000327/032763eo.pdf

UNICEF (2016). *Fairness for Children. A league table of inequality in child well-being in rich countries, Innocenti Report Card no. 13,* Accessed August 2018 https://www.unicef-irc.org/publications/830-fairness-for- children-a-league-table-of-inequality-in-child-well-being-in-rich-countries.html

UNESCO (2017). *Education for Sustainable Development Goals: Learning Objectives* Accessed August 2018 http://unesdoc.unesco.org/images/0024/002474/247444e.pdf

Van den Berg, A. E., Hartig, T., & Staats, H. (2007). Preference for nature in urbanized societies: Stress, restoration, and the pursuit of sustainability. J*ournal of social issues*, 63(*1*), 79-96. https://doi.org/10.1111/j.1540- 4560.2007.00497.x

Victoria Department of Education https://www.education.vic.gov.au/childhood/providers/regulation/Pages/bushkinders.aspx

Vining, J., Merrick, M. S., & Price, E. A. (2008). The distinction between humans and nature: Human perceptions of connectedness to nature and elements of the natural and unnatural. *Human Ecology Review*, 1-11.

Waite, S. (2010). Losing our way? The downward path for outdoor learning for children aged 2–11 years. *Journal of Adventure Education & Outdoor Learning*, 10(2), 111-126.

Wells, N. M., & Lekies, K. S. (2006). Nature and the life course: Pathways from childhood nature experiences to adult environmentalism. *Children Youth and Environments*, 16(1), 1-24.

World Health Organization. (2003). *Creating an environment for emotional and social well-being : an important responsibility of a health promoting and child-friendly school.* Accessed August 2018 http://www.who.int/iris/handle/10665/42819

Zelenski, J. M., & Nisbet, E. K. (2014). Happiness and feeling connected: The distinct role of nature relatedness. *Environment and behavior*, 46(1), 3-23

Appendix iii

education sciences

MDPI

Brief Report

Refocusing Environmental Education in the Early Years: A Brief Introduction to a Pedagogy for Connection

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Abstract: The aim of this article is to introduce an effective, evidence-informed, and developmentally appropriate framework of practice for Environmental Education (EE) in the early years, with the ultimate goal being to achieve environmental sustainability. Initially, the author will briefly examine the current state of EE in the early years, contextualising it within a gradual shift from EE to the more encompassing Education for Sustainable Development (ESD). The article then proposes that there is a need for a refocusing of EE in the early years that has as a central goal—the promotion of nature connectedness, benefiting both the next generation of learners, as well as our planet. A four-point draft of a pedagogy for connection will be outlined that comprises sustained contact, engagement with nature's beauty, cultivation of compassion towards non-human nature, and mindfulness. The latest empirical research from ecopsychology and developmental psychology will be used throughout in order to synthesise this brief initial draft of a pedagogy for connection.

Keywords: environmental education; sustainability; early childhood; nature connectedness; pedagogy; ecocentric education

Introduction

The United Nations declared the first part of the 21st century (2004–2015) as the Decade of Education for Sustainable Development [1]. This declaration marked a shift that began in the 1980s which some [2] saw as a replacement of Environmental Education (EE) with the broader concept of Education for Sustainable Development (ESD). Others made a clear distinction between the roles of EE and ESD [3], seeing EE as a distinct form of education separate from, but related to, ESD. Whichever way the move was interpreted, what

is clear is that it signalled a subtle but real shift away from the ecocentric goals of EE towards a more anthropocentric drive for development[4].

This article aims to assist in refocusing EE—especially as this pertains to the first years of education, in early childhood—as an education *in*, *for*, and *about* the environment [5]. Moreover, it wants to reinstate environmental sustainability and positive changes in learner behaviour EE's ultimate goals [6] and, finally, briefly draft a pedagogical framework that is based around the building of relationships between human and non-human nature, bridging the notional divide. The construct of nature connectedness will be central to this framework, and the latest evidence from environmental psychology will be used to outline ways that promote such a connection with nature. Additionally, some developmentally appropriate pedagogical practices will be suggested.

Responsible environmental behaviour (REB) has commonly been seen in the past as a worthwhile goal for EE programmes [7,8]. ESD has similarly been focused on REB, although the pedagogical aspects of how to achieve this have not commonly been articulated [9]. The framework proposed here attempts to put REB, through its positive association with nature connectedness, at the centre of EE in the early years.

Early years' education has always placed great emphasis on the environment, in both indoor and outdoor education (Pestalozzi, Froebel, Montessori, Dewey, etc.). Moreover, access to the natural environment, in the form of outdoor learning, has become an important part of several early childhood curricula and frameworks, such as that of England [10], Scotland [11], Australia [12], and parts of Canada [13,14].

This movement towards greater access to the outdoors and natural environments has further been strengthened by research conducted at the end of the 20th and the beginning of 21st century, confirming a number of benefits for children who have regular contact with the outdoors [15]. In fact, these social, emotional, and cognitive benefits are a distinct driver and motivation for the inclusion of outdoor learning in curricula around the world. This has led to a rapid growth of outdoor preschools, many of them in natural settings, in many of the industrialised countries, including Germany [16], Denmark [17], and the United States [18] amongst others. This article is, therefore, a timely addition to the international literature that can help to provide a direction in which early years' education in the natural environment can move towards. The author hopes this will be useful for practitioners, as well as researchers.

To a large extent, this growth has, so far, been driven by an anthropocentric pursuit of the purported benefits to humans of spending time in natural environments. While these benefits are of paramount importance, a more ecocentric, post-humanist approach to education can emphasise the infinite benefits for nature and the possibilities for REB via the strengthening of the bond between human and non-human nature [19]. In this sense, non-human nature can move away from being used merely as an instrument in the development of the child and, by taking a post-humanist perspective towards education, it can become a vital part of an EE that will benefit both humans and non-humans alike.

This article proposes that an ecocentric orientation could rest upon the construct of nature connectedness for the articulation of a distinct pedagogy that will aim to bridge this notional divide between humans and non- humans, and encourage children to feel that they are part of nature. In this way, education can be considered more from a point of view of relationality and interconnectedness, of building a meaningful relationship, and less from the point of view of gaining knowledge and understanding. Previous research on children has found that connectedness to nature has been a stronger driver of ecological behaviours than environmental knowledge [20]. This pedagogy of connectedness, articulated below using recent experimental evidence from ecopsychology, is particularly suited to early childhood which has been identified as a key time when skills, like empathy, emerge and are nurtured [21]. Moreover, this initial development of empathy in early childhood has been found to predict later pro-

social behaviour [22]. Using this as a basis, this article argues, from a theoretical perspective, that nurturing early childhood empathy towards non-human nature could predict later pro-environmental behaviours and compassion towards non-human animals.

Although there is currently no empirical data to support this as it relates to early childhood (3–8 years of age), two key articles have explored the relationship between pro-environmental behaviours and beliefs, and childhood experiences up to the age of 11 years. The first, a retrospective study of approximately 2000 US adults, linked natural experiences in childhood with adult environmentalism [23]. The second was a paper that further linked time spent outdoors, nature connectedness, and environmental stewardship in children [24]. Both identified that a closeness to nature, either through behaviour or nature connectedness, was associated with environmentally protective behaviours. Other studies have also linked emotional affinity to nature and nature- protective behaviours [20,25,26].

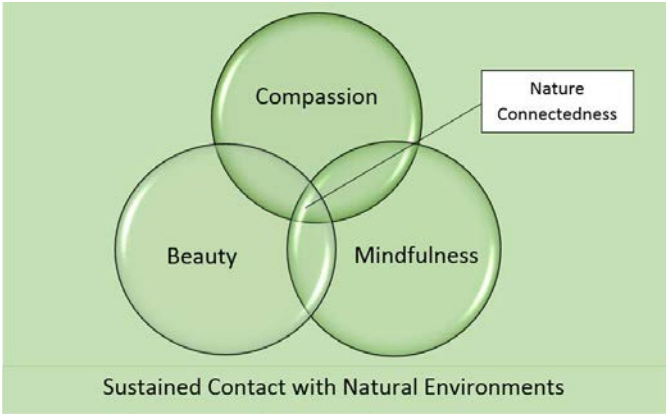
Pro-environmental behaviours cannot fully be explained by cognitive factors, and affective factors and emotional motivations also play distinct roles [25]. The value–belief–norm model [27] purports the idea that it is values that activate cognitions, which further produce personal norms in relation to environmental behaviours. Studies have further linked nature connectedness with such values [28,29].

Developmentally, early childhood is a good time to promote empathy and pro-social behaviours [21]. This short communication aims to outline some of the ways by which EE in the early years can be underlined by the construct of nature connection. In this way, EE in the early years is refocused to include a strong element of *for* the environment [5]. Moreover, with nature connection as a distinct aim of early years' EE, aspects of a pedagogy for connection to nature and to non-human animals will be briefly outlined.

A Pedagogy for Connection

The first draft of a pedagogy for connection that will be presented below is partly based on Lumber et al. [30]. They undertook three studies, grounded on the biophilia hypothesis [31] to identify the pathways through which nature connectedness is achieved. This is further enhanced by literature from developmental psychology, and further evidence from the fields of ecopsychology. Lumber et al. [30] identified the following pathways to nature connection: contact, emotion, meaning, compassion, and beauty. Figure 1 outlines the four main elements and their interrelation.

Figure 1. Schematic representation of the framework for a pedagogy for connection.



Based on these elements, the following foundational guidelines for a pedagogy for connection can be articulated.

1.1. Regular Contact with Nature

Having regular access to natural spaces, both wild and managed, should underpin all early childhood education [32]. This is especially true for any EE programmes that focus on connecting with nature, thus remaining true to the original aims of early years' EE as an education *in* and *about* the environment [5]. Contact with natural environments has been identified as a pathway to connecting with nature [30]. Physical and adventurous activities in nature have also been found to promote nature connection [33]. For this reason, regular and sustained contact with natural environments should be central to an EE pedagogy for connection. This feature is already in place in many early childhood EE programmes, as well as some mainstream early childhood pedagogical approaches in numerous Western countries, and will not be developed any further in this article. As shown in Figure 1, contact, although a separate pathway to connection, is seen as a constant and a prerequisite for developing the other three aspects. These three specific aspects of connection— namely engaging with nature's beauty, developing compassion towards non-human species, and the practice of mindfulness—will be explored furtherbelow.

1.2. Engaging with Nature's Beauty

The aesthetic appeal of nature plays an important role in promoting a connection with the natural world [30,34,35]. Being able to notice and engage with beauty in the environment, should, therefore, be a focus of a pedagogy for connection. This appreciation for natural beauty may take many forms, from simply noticing and noting (see here the links with mindfulness below), to capturing nature's beauty in various artistic forms. An easy way to incorporate such a practice in an early years' programme would be to spend some time each day noticing three beautiful things in the nearby natural environment, and discussing them with a practitioner. Such an activity has been used as an intervention that showed marked changes in nature connectedness in adults [36] Finally, engaging with nature's beauty through art has also been found to enhance nature connectedness in children in an empirical study [37], further supporting the argument made in this section.

1.3. Developing Compassion for the Non-Human

Compassion is a complex mental state that begins to develop in childhood and continues to develop throughout the lifespan [38]. The following key elements of compassion have been identified in the past: "(1) Recognizing suffering; (2) Understanding the universality of suffering in human experience; (3) Feeling empathy for the person suffering and connecting with the distress (emotional resonance); (4) Tolerating uncomfortable feelings aroused in response to the suffering person (e.g., distress, anger, fear) so remaining open to and accepting of the person suffering; and (5) Motivation to

act/acting to alleviate suffering" [39] (p. 19).

As is clear, the definition above focuses on the human element, but the author proposes that there is no reason why this definition cannot be used as a framework for nurturing compassion towards non-human nature. Past research has indeed linked empathy towards humans and empathy towards animals [40]. There are many ways that compassion can be nurtured in early childhood. Several that have been supported by the literature include direct contact with, and care, for non- human animals [41], encouraging quiet observation of animals in their natural environment [42], encouraging perspective taking, which is the first step towards developing empathy [43] and, finally, anthropomorphising nature [44,45].

Anthropomorphism is the process of attributing human qualities to non-human entities (both living, non- living, and abstract). This process of anthropomorphising nature has been found, in several experimental studies, to promote nature connectedness and protective feelings towards the natural world, fostering conservation behaviours [46]. Although these studies have limitations in that they sampled undergraduate students, further research on young children could shed more light on this association. However, we can hypothesise that the process of anthropomorphising may facilitate perspective taking and, therefore, empathy, the third element of compassion as per the definition above [39]. Finally, it may enhance motivation to act in a compassionate way, the fifth element of compassion [39].

1.4. Practising Mindfulness

There is a growing body of evidence that explores the associations between mindfulness and nature connection [47–49], and significant links have been found between mindfully engaging with nature and nature connectedness [48]. Moreover, earlier research has linked mindfulness with sustainable behaviours [9,47], with the proposed mechanism being that mindfulness promotes better self-world connection and awareness of actions, leading away from automaticity and resulting in a greater ability to regulate one's behaviour [50,51].

Although there is no evidence for mindfulness in nature interventions in preschoolers, there are several studies in adults that demonstrate links between mindfulness and connection. A recent study of 115 undergraduates reports that engaging with mindfulness, even outside of a natural setting, can increase both social and nature connectedness [52]. Moreover, learning mindfully, which is characterised by openness in thinking and perspective taking amongst other features, was associated with an increase in nature connectedness, both in affective and cognitive terms [48].

There is a dearth of mindfulness programme evaluations in the preschool age range, and certainly none to date have looked at nature connection or mindfulness within a natural environment. However, in a study conducted on preschool children in the United States, researchers observed that a mindfulness-based 12-week- long kindness curriculum significantly increased pro-social behaviours and emotional regulation [53]. These two skills are certainly linked with nurturing compassion, as was outlined above. Finally, engaging with nature mindfully could have the desired effect in providing the skills to appreciate nature's beauty more deeply [54]. This further links to the second point in the framework.

Conclusions

This short article aimed to use existing evidence from the literature to outline a framework for early childhood EE that places connection to nature at its core and has environmental protection as its ultimate goal. Central to the proposed framework—besides regular contact with nature, which is already a common feature of early childhood education practice in many countries—are the elements of engaging with nature's beauty, cultivating compassion towards non-human nature, and mindfulness. These four elements, as outlined above, have several areas of intersection between them. Although the framework is primarily constructed upon current empirical research, there are, inevitably, several limitations. The most notable limitation stems from the fact that a substantial amount of the evidence is largely taken from studies with adult participants, most commonly students. This may affect their generalisability to children in their early years. Moreover, some studies looking at childhood experiences are retrospective in design, again, with adult participants. This also presents methodological limitations.

Future research in this area should focus on two axes. One would be the development and validation of a measuring instrument for nature connectedness that can be used with children in the early years. The second axis should focus on measuring the effect of the practices outlined above on children's relationship with nature, compassion towards non-human nature, and pro-environmental beliefs and actions. Such studies would ideally be longitudinal in design to capture the effects of such early childhood EE programmes that ultimately focus on sustainability behaviours.

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References

1. United Nations. *Decade of Education for Sustainable Development*; UNESCO: Paris, France, 2005. Available online: http://unesdoc.unesco.org/images/0014/001416/141629e.pdf (accessed on 20 November2018).
2. De Haan, G.; Harenberg, D. Bildung für Eine Nachhaltige Entwicklung; 1999. Available online: http://www.blk- bonn.de/papers/heft72.pdf (accessed on 23 December 2018).
3. McKeown, R.; Hopkins, C. EE p ESD: Defusing the worry. *Environ. Educ. Res.* **2003**, *9*, 117–128, doi:10.1080/13504620303469.
4. Kopnina, H. Education for sustainable development (ESD): The turn away from 'environment' in environmental education? *Environ. Educ. Res.* **2012**, *18*, 699–717, doi:10.1080/13504622.2012.658028.
5. Davis, J. Young Children, Environmental Education, and the Future. *Early Child. Educ. J.* **1998**, *26*, 117–123, doi:10.1023/A:1022911631454.
6. Hungerford, H.R.; Volk, T.L. Changing Learner Behavior Through Environmental Education. *J. Environ. Educ.* **1990**, *21*, 8–21. Available online: http://www.elkhornsloughctp.org/uploads/files/1374624954Changing%20learner%20behavior%20-

%20H%20and%20V.pdf (accessed on 21 November 2018).

7. Bogner, F.X. The Influence of Short-Term Outdoor Ecology Education on Long-Term Variables of Environmental Perspective. *J. Environ. Educ.* **1998**, *29*, 17–29, doi:10.1080/00958969809599124.
8. Hines, J.M.; Hungerford, H.R.; Tomera, A.N. Analysis and Synthesis of Research on Responsible Environmental Behavior: A Meta-Analysis. *J. Environ. Educ.* **1987**, *18*, 1–8, doi:10.1080/00958964.1987.9943482.
9. Eilam, E.; Trop, T. ESD Pedagogy: A Guide for the Perplexed. *J. Environ. Educ.* **2010**, *42*, 43–64, doi:10.1080/00958961003674665.
10. DfES. Learning Outside the Classroom Manifesto, Department for Education and Skills 2006. Available online: http://www.lotc.org.uk/wp-content/uploads/2011/03/G1.-LOtC-Manifesto.pdf (accessed on 3 July 2018).
11. Brown, K. Curriculum for excellence through outdoor learning, Learning and Teaching Scotland 2010. Available online: https://education.gov.scot/Documents/cfe-through-outdoor-learning.pdf (accessed on 3 July 2018).
12. Australian Government. Belonging, Being & Becoming—The Early Years Learning Framework for Australia 2009. Available online: https://docs.education.gov.au/node/2632 (accessed on 15 August 2018).
13. Makovichuk, L.; Hewes, J.; Lirette, P.; Thomas, N. Play, Participation, and Possibilities: An Early Learning and Child Care Curriculum Framework for Alberta 2014. Available online: http://childcareframework.com/resources/Play,%20Participation,%20and%20Possibilities%20-%20An%20Early%20Learning%20and%20Child%20Care%20Curriculum%20Framework%20for%20Alberta.pdf (accessed on 15 August 2018).
14. Nova Scotia. Capable, Confident and Curious: Nova Scotia's Early Learning Curriculum Framework 2018. Available online: https://www.ednet.ns.ca/docs/nselcurriculumframework.pdf (accessed on 15 August 2018).
15. Gill, T. The Benefits of Children's Engagement with Nature: A Systematic Literature Review. *Child. Youth Environ.* **2014**, *24*, 10–34.
16. BVNW. Federation for Nature and Nature Kindergartens in Germany 2018. Available online http://bvnw.de/uber-uns/ (accessed on 12 July 2018).
17. Danish Ministry of Foreign Affairs. Forest Preschools 2017. Available online: http://denmark.dk/en/meet- the-danes/forest-preschools (accessed on 12 July 2018).
18. North American Association for Environmental Education (NAAEE). *Nature Preschools and Forest Kindergartens: 2017 National Survey*; NAAEE: Washington, DC, USA, 2017.
19. Bonnett, M. *Retrieving Nature: Education for a Post-Humanist Age*; Blackwell: Oxford, UK, 2004; pp. 1–5.
20. Otto, S.; Pensini, P. Nature-based environmental education of children: Environmental knowledge and connectedness to nature, together, are related to ecological behaviour. *Glob. Environ. Chang.* **2017**, *47*, 88– 94, doi:10.1016/j.gloenvcha.2017.09.009.
21. Roth-Hanania, R.; Davidov, M.; Zahn-Waxler, C. Empathy development from 8 to 16 months: Early signs of concern for others. *Infant Behav. Dev.* **2011**, *34*, 447–458, doi:10.1016/j.infbeh.2011.04.007.
22. Taylor, Z.E.; Eisenberg, N.; Spinrad, T.L.; Eggum, N.D.; Sulik, M.J. The Relations of Ego-Resiliency and Emotion Socialization to the Development of Empathy and Prosocial Behavior Across Early Childhood. *Emotion* **2013**, *13*, 822–831, doi:10.1037/a0032894.
23. Wells, N.M.; Lekies, K.S. Nature and the life course: Pathways from childhood nature experiences to adult environmentalism. *Child. Youth Environ.* **2006**, *16*, 1–24.
24. Andrejewski, R.; Mowen, A.J.; Kerstetter, D.L. An Examination of Children's Outdoor Time, Nature Connection, and Environmental Stewardship. Available

online: https://scholarworks.umass.edu/cgi/viewcontent.cgi?referer=https://www.google.co.uk/&httpsredir=1&article=1001&context=nerr (accessed on 12 July 2018).

25. Kals, E.; Schumacher, D.; Montada, L. Emotional Affinity toward Nature as a Motivational Basis to Protect Nature. *Environ. Behav.* **1999**, *31*, 178–202, doi:10.1177%2F00139169921972056.
26. Nisbet, E.K.; Zelenski, J.M.; Murphy, S.A. The Nature Relatedness Scale. *Environ. Behav.* **2008**, *41*, 715–740, doi:10.1177/0013916508318748.
27. Stern, P.C., T.; Dietz, T.; Abel, G.A. Guagnano and L. Kalof. A value-belief-norm theory of support for social movements: The case of environmentalism. *Hum. Ecol. Rev.* **1999**, *6*, 81–97
28. Pereira, M.; Forster, P. The relationship between connectedness to nature, environmental values, and pro-environmental behaviours. Available online: https://warwick.ac.uk/fac/cross_fac/iatl/reinvention/issues/volume8issue2/pereira/ (accessed on 28 December 2018).
29. Restall, B.; Conrad, E. A literature review of connectedness to nature and its potential for environmental management. *J. Environ. Manag.* **2015**, *159*, 264–278.
30. Lumber, R.; Richardson, M.; Sheffield, D. Beyond knowing nature: Contact, emotion, compassion, meaning, and beauty are pathways to nature connection. *PLoS ONE* **2017**, *12*, e0177186, doi:10.1371/journal.pone.0177186.
31. Kellert, S.R., Wilson, E.O. *The Biophilia Hypothesis*; Island Press: New York, NY, USA, 1995.
32. Barrable, A. The Case for Nature Connectedness as a Distinct Goal of Early Childhood Education. *Int. J. Early Child. Environ. Educ.* in review.
33. Martin, P. Outdoor adventure in promoting relationships with nature. *J. Outdoor Environ. Educ.* **2004**, *8*, 20– 28.
34. Zhang, J.W.; Howell, R.T.; Iyer, R. Engagement with natural beauty moderates the positive relation between connectedness with nature and psychological well-being. *J. Environ. Psychol.* **2014**, *38*, 55–63, doi:10.1016/j.jenvp.2013.12.013.
35. Richardson, M.; Hallam, J.; Lumber, R. One Thousand Good Things in Nature: Aspects of Nearby Nature Associated with Improved Connection to Nature. *Environ. Values* **2015**, *24*, 603–619, doi:10.3197/096327115X14384223590131.
36. Richardson, M.; Sheffield, D. Three good things in nature: Noticing nearby nature brings sustained increases in connection with nature/Tres cosas buenas de la naturaleza: Prestar atención a la naturaleza cercana produce incrementos prolongados en conexión con la naturaleza. *Psyecology* **2017**, *8*, doi:10.1080/21711976.2016.1267136.
37. Bruni, C.M.; Winter, P.L.; Schultz, P.W.; Omoto, A.M.; Tabanico, J.J. Getting to know nature: Evaluating the effects of the Get to Know Program on children's connectedness with nature. *Environ. Educ. Res.* **2015**, *23*, 43–62.
38. Roeser, R.W.; Colaianne, B.A.; Greenberg, M.A. Compassion and Human Development: Current Approaches and Future Directions. *Res. Hum. Dev.* **2018**, *15*, 238–251, doi:10.1080/15427609.2018.1495002.
39. Strauss, C.; Taylor, B.L.; Gu, J.; Kuyken, W.; Baer, R.; Jones, F.; Cavanagh, K. What is compassion and how can we measure it? A review of definitions and measures. *Clin. Psychol. Rev.* **2016**, *47*, 15–27, doi:10.1016/j.cpr.2016.05.004.
40. Elizabeth, S. Paul Department of Psychology; University of Edinburgh; Ukcorrespondencee.Paulbris.Ac.Uk Empathy with Animals and with Humans: Are They Linked? *Anthrozoös* **2000**, *13*, 194–202, doi:10.2752/089279300786999699.

41. Hawkins, R.D.; Williams, J.M.; Tchounwou, P.B.; Scottish Society for the Prevention of Cruelty to Animals (Scottish SPCA). Childhood Attachment to Pets: Associations between Pet Attachment, Attitudes to Animals, Compassion, and Humane Behaviour. *Int. J. Environ. Res. Public Health* **2017**, *14*, 490.
42. Selly, P.B. *Connecting Animals and Children in Early Childhood*; Redleaf Press: St Paul, MN, USA, 2014.
43. Denham, S.A. Social Cognition, Prosocial Behavior, and Emotion in Preschoolers: Contextual Validation. *Child Dev* **1986**, *57*, 194–201.
44. Vining, J. The connection to other animals and caring for nature. *Res. Hum. Ecol.* **2003**, *10*, 87–99.
45. Tam, K.-P.; Lee, S.-L.; Chao, M.M. Saving Mr. Nature: Anthropomorphism enhances connectedness to and protectiveness toward nature. *J. Exp. Soc. Psychol.* **2013**, *49*, 514–521, doi:10.1016/j.jesp.2013.02.001.
46. Wang, X.; Geng, L.; Zhou, K.; Ye, L.; Ma, Y.; Zhang, S. Mindful learning can promote connectedness to nature: Implicit and explicit evidence. *Conscious. Cogn.* **2016**, *44*, doi:10.1016/j.concog.2016.06.006.
47. Barbaro, N.; Pickett, S.M. Mindfully green: Examining the effect of connectedness to nature on the relationship between mindfulness and engagement in pro-environmental behavior. *Personal. Individ. Differ.* **2016**, *93*, 137–142, doi:10.1016%2Fj.paid.2015.05.026.
48. Howell, A.J.; Dopko, R.L.; Passmore, H.-A.; Buro, K. Nature connectedness: Associations with well-being and mindfulness. *Personal. Individ. Differ.* **2011**, *51*, 166–171.
49. Amel, E.L.; Manning, C.M.; Scott, B.A. Mindfulness and Sustainable Behavior: Pondering Attention and Awareness as Means for Increasing Green Behavior. *Ecopsychology* **2009**, *1*, 14–25.
50. Bargh, J.A.; Chartrand, T.L. The unbearable automaticity of being. *Am. Psychol.* **1999**, *54*, 462–479, doi:10.1037/0003-066X.54.7.
51. Langer, E.J.; Moldoveanu, M. The Construct of Mindfulness. *J. Soc. Issues* **2000**, *56*, 1–9.
52. Aspy, D.J.; Roeve, M. Mindfulness and loving-kindness meditation: Effects on connectedness to humanity and to the natural world.
Psychol. Rep. **2017**, *120*, 102–117, doi:10.1177%2F0033294116685867.
53. Flook, L.; Goldberg, S.B.; Pinger, L.; Davidson, R.J. Promoting prosocial behavior and self-regulatory skills in preschool children through a mindfulness-based kindness curriculum. *Dev. Psychol.* **2014**, *51*, 44–51, doi:10.1037/a0038256.
54. Ballew, M.T.; Omoto, A.M. Absorption: How Nature Experiences Promote Awe and Other Positive Emotions. *Ecopsychology*
2018, *10*, 26–35.

Appendix iv, a

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ORIGINAL PAPER

Shaping space and practice to support autonomy: lessons from natural settings in Scotland

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Abstract

In the present paper, I explore some of the concrete manifestation of autonomy support in natural childcare and early childhood education settings, under the organising framework of self-determination theory. More specifically, I present the ways in which early childhood educators shape the space of natural settings and use the affordances of the natural environment to promote autonomy in children aged 3–8 years. The practices presented are a result of direct observation in several Scotland-based outdoor settings, observations and organic conversations with educators in outdoor and forest kindergartens. Hopefully the practices and spaces presented in this paper can be of use by educators and setting managers who aim to support autonomous learning and intrinsic motivation in their pupils in outdoor natural early years' settings.

Keywords Autonomy · Early childhood · Forest school · Practice · Self- determination theory

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Introduction

Self-Determination Theory (SDT) identifies autonomy as one of the basic psychological needs for humans to develop optimally and flourish within their environment (Ryan and Deci 2017). Autonomy within SDT retains the literal meaning of the word as rule by the self (Ryan and Deci 2006). Being autonomous is about acting with full volition and self- endorsement but, within SDT, the concept of autonomy is quite distinct from independence (Ryan 1993). Indeed, to define autonomy fully, one needs to take into account the external environment, because being fully autonomous indicates that the individual's actions are coherent with both self and environment (Deci and Vansteenkiste 2004).

In this respect, when we think about autonomy in young children, the environment and socialising agents (e.g. parents, teachers) must be actively supportive of the child's tendency to lead the self. In traditional educational contexts (e.g. classroom), Autonomy Sup- port (AS) and autonomy supportive teachers have been found to correlate with higher academic achievement (Boggiano et al. 1993; Flink et al. 1990). The way in which students perceived their own competence in relation to academic tasks is also related to AS teaching practices, with more AS linked to higher perceived competence (Deci et al. 1981; Ryan and Grolnick 1986). In this way, higher AS levels of various social agents, including teachers, parents and school administrators, are related to a heightened sense of competence and autonomy, as well as to better chances of staying in school and avoiding dropout in teenagers (Vallerand et al. 1997).

However, autonomy supportive practices in education differ according to the develop- mental needs of the child. Early childhood is a time when autonomy starts developing and the young child's need to pursue her own interests starts becoming apparent, while her behaviour can become increasingly volitional (Erikson 1993; Kopp 1982). This tendency towards self-regulation can be supported or thwarted by the actions of socialising agents (education and child-care practitioners and parents) (Sokol et al. 2013). Although early childhood is crucial to this development of self-regulation, through AS practices, very little attention has been focused on this life stage, especially with regards to child care and educational settings.

Autonomy support as a beneficial aspect of parenting practices has been observed in a number of studies, including benefits to executive function (Bernier et al. 2010), mastery related behaviour (Frodi et al. 1985), children's engagement in conversation (Cleveland et al. 2007) and rule internalisation (Laurin and Joussemet 2017). On the other hand con- trolling parenting practices, such as overprotection and coercion, were found to increase children's anxiety levels (Laurin and Joussemet 2017).

Although the literature supports the idea that AS can benefit children, all cited studies above involved the parent as socialising agent. The child care practitioner, and the manifestations of AS within a childcare/early education setting, have not been studied in any depth. To date, only one study has focused on AS practices within early childhood education settings (Côté-Lecaldare et al. 2016). This small qualitative study gives us a glimpse of the types of practices and behaviours within a childcare setting that support toddlers' autonomy, beyond those that are traditionally conceptualised for older children (Koestner et al. 1984). The children in the settings studied were between 18 and 36 months of age, and the practitioners interviewed for this qualitative study valued AS in their childcare set- ting. Some such practices included being sensitive and responsive, close observation of the toddler, modelling and scaffolding behaviours and giving responsibilities (Côté- Lecaldare et al. 2016).

Outdoor learning environments and the pedagogical practices associated with them have been recognised in the past as conducive to AS (Barrable and Arvanitis 2019; Maynard 2007; Wurdinger and Paxton 2003). The affordances of the natural environment, including a great variety of flexible and open-ended play items, such as naturally occurring loose parts, offer an ideal space for child-led exploration and play (Barrable and Arvanitis 2019), as well as enhanced opportunities for deep adult–child interactions that are child-initiated and responsive to the child's own interests (Waters and Maynard 2010). These child- led interactions, as well as the provision of space and time for child-led play and exploration, can be seen as the manifestation of autonomy supportive practice in early childhood education.

Nature schools and play-based outdoor learning in general have seen a steep growth in many countries around the world. National and regional curricula have introduced outdoor learning expectations in Australia (ACARA n.d.), New Brunswick, Canada (Department of Education 2017) and Ireland (Early Childhood Curriculum Framework 2015). Moreover, different types of forest school practice have developed in countries such as South Africa, Portugal, Brazil, Slovenia, India and Italy (Knight 2013). In the US, nature-based preschools are a growing trend, with the rate of growth having greatly increased in the last 5 years. A Natural Start Alliance (NSA) national survey concluded that there are over 250 of them operating in 43 states (NSA 2017). In Scotland, the first outdoor nursery opened in 2008 in Fife (Care Inspectorate 2018). By November 2018, 19 early learning and childcare settings across the whole of Scotland had moved into forest locations, with a lot more incorporating some aspect of regular outdoor learning in their programmes (Care Inspectorate 2018). Therefore messages and recommendations of this article are applicable not only to the more established UK forest school practice, but can enhance outdoor learning practices in all nature- based settings around the world.

This growth in the number of settings has been accompanied by an increasing interest in the practice of learning and teaching in such environments. However, literature so far has mainly focused on the activities taking place in natural environments (Doyle and Milchem 2012; Knight 2011a, b), the benefits of the environment in terms of psychological and cognitive measures (O'Brien 2009; Ulset et al. 2017) and the interactions of adult and child within such environments (Waters and Maynard 2010). Moreo- ver, there have been excellent studies that have focused on the person–environment relationship, that have used Ecological Dynamics theory as a framework (Sharma- Brymer et al. 2018), proposed pedagogical frameworks using previous research (Barrable 2019), and investigated a sense of autonomy in space in a home context (Green 2013). The latter paper brought forward 4 key activities that represented the children's autonomous experience of place: playing, exploring, resting and hiding. In this paper, these four activities, along with the ED approach of affordances, informs the interpretation of findings, adding to it a clearer focus on the SDT psychological need of autonomy and autonomy supportive environments.

Learning Environments (LE) research has involved the physical, social and instructional aspects of the LE, their measurement and respective effects on student outcomes (Shavelson and Seidel 2006). Research has identified the LE as a valuable 'alterable'variable that can positively affect cognitive, behavioural and affective student out- comes (Waxman and Huang 1996, 1997; Waxman et al. 1992, 1997). Although most LE research has focused on indoor and traditional classroom environments, some studies have involved aspects of LE in the outdoors. Nedovic and Morrissey (2013) have explored such an environment in an action research project, focusing on changes in an outdoor space and their effect

on children's responses to those changes. Other studies have focused on intentionally shaping outdoor LE in the context of field trips (Tal 2001; Zaragoza and Fraser 2017) as well as other outdoor spaces (Dahl et al. 2013; Peacock and Pratt 2011). On the other hand, there have been LE studies of various psychosocial measures that relate to both wellbeing and motivation (Salmi and Thuneberg 2018) and that have combined psychosocial outcomes with physical contextual factors (Liu et al. 2012). These include both quantitative and qualitative studies that utilise SDT as an organising framework (Alfassi 2004; Wijnen et al. 2018). However, to the best of the researcher's knowledge, no work to date has explored the shaping of natural environments (e.g. forests to support students' basic psychological need of autonomy).

The present project primarily was guided by two research aims:

1. To explore how the natural spaces are *shaped* by practice that is committed to supporting autonomy.
2. To explore how natural spaces themselves *shape* autonomy supportive practices.

Methodology

The research approach used in this project is based on an ethnographic methodology, in order to "build[…] theories of cultures—or explanations of how people think, believe, and behave—that are situated in local time and space" (LeCompte and Schensul 2010, p. 12). The researcher felt that context in this instance was key for situating the behaviour and interaction. Ethnography was thought to provide a useful methodology by which decontextualisation is prevented, through direct observation of the interactions of child–environment and child–adult, as well as the careful consideration of the role of 'space' as an important context for learning social norms (Boellstorff et al. 2012).

Two research strategies for data collection were implemented: (1) non- participant observation, and (2) informal conversations with practitioners. Non- participant observation (i.e. observation from a distance) was considered appropriate because it influenced the behaviours of those involved in the interactions as little as possible (Gobo 2008). Field notes were taken at the time, while photography was used to capture the space after the observation was complete and with no children present. Finally, informal con- versations with practitioners while walking around the grounds were undertaken, and both descriptive and reflective field notes were taken.

Five different forest nursery settings in Scotland were visited. In two of these, the researcher observed children during their time at the nursery with a total of 6 h being observed. The other three settings were explored with the help of a practitioner, with informal conversations taking place about the space, its use and ways of shaping it.

The settings and participants

All five settings were in a forest and ranged from 3 to 21 acres in space. Each forest setting corresponded to one nursery school, and they included different types of forest environments, namely, native pinewoods and broad-leaf forests (upland birchwoods and lowland mixed deciduous). The observations took place across a 3-week period in early spring, although the weather ranged from cold and rainy to sunny and warm—weather conditions are relevant as they affect children's interactions both with the environment and the adults around them. Six female practitioners, one each from the five different settings and with two practitioners coming from the same setting, spent time talking to the researcher. The fact that they were all female is not surprising, because only 4% of early childhood practitioners in Scotland are male (Scottish Government 2018). Of the six, two were qualified teachers who had previous experience of working in indoor set- tings, but had chosen the alternative forest nurseries as a place of employment. These were both lead practitioners with extensive experience. Of the remaining four, two were qualified early childhood educators, while the other two held other qualifications, such as forest school level three certification. Experience levels varied, but all practitioners had been in position for over a year, although one practitioner was a sessional worker working on an ad hoc basis.

Finally, the children attending the nature pre-schools were aged 3–8 years. All set- tings were in rural areas of Scotland, with children coming from a variety of backgrounds, because for some settings

state funding could be accessed to cover attendance fees. How- ever, lead practitioners in two of the settings noted that there were barriers for children of lower socio-economic status attending because of a

lack of transport in one case, it was mentioned that funding was sought to broaden participation to children from local villages who might not have had the means to attend or access to viable transport options.

Analysis

Analysis of the data focused on an inductive thematic approach, as is common in ethno- graphic research (Reeves et al. 2008). Data were unstructured at the point of analysis, which involved interpretation of both the meaning and function of the actions and environments observed. Moreover, the researcher's field notes were repeatedly reworked in order to distil some of the key themes that emerged, as well as to give the reader of this article a sense of immersion in the practice and place (Jarzabkowski et al. 2014). The informal conversations that took place allowed the researcher to probe and ask open-ended questions to gain a deeper understanding of motivations, intentions and thinking behind certain action on the part of the practitioner, when shaping the learning environment in the forest setting. To increase reliability, explicit research method triangulation was used through the collection of data additional to the interviews, in the form of field notes from observations and photographs of the natural environment (Flick 2004). Moreover, geographic triangulation was also used to compare findings from different locations (Wilson 2006).

Results

In order to present the findings, collected through observations, interviews and photo- graphs, the researcher decided to try to group some of the observations that were made into themes. Within those themes, a description of some of the observations or discussions that took place are used as illustrations and examples for practice in other similar spaces (Jarzabkowski et al. 2014). Four key headings are defined: Structure, Ownership of space, Affordance and Risk. The reader is asked to reflect upon the ways in which these implicate all three aspects of the LE, namely, the practitioner, child and natural environment. Of these, two have already been identified by LE research, namely, affordance (Nedovic and Morrissey 2013) and structure (Reeve and Halusic 2009), while the other two tie closely with ideas of autonomy and self-direction as explored by Barrable and Arvanitis (2019). All are underlined by the practitioner's willingness to support the autonomy of the child and endorse self-directed activities.

Structure

For the purpose of analysis and to ground the analysis into an SDT-informed framework, the concept of structure initially was used to categorise some of the practices in question. Structure within SDT is seen as complementary to and works with autonomy support to improve engagement in activities (Hospel and Galand 2016). Moreover, the SDT literature suggests that a clear structure framework is related to a lot of positive outcomes, including self-regulated learning, higher motivation to learn, and less problem behaviour in children (Vansteenkiste et al.
2012). However, structure in the classroom is very much manifested as good organisation, clear objectives, constructive and informative feedback and a clear action plan on the part of the teacher—in an

environment such as the forest, structure has different manifestations.

The manifestations of structure as noted through the observations and discussions with participants clearly centre around two aspects of practice that are considered below: the structure of time; and the structure of place.

Structure of time

It is often lamented that children don't spend much time in unstructured pursuits mainly because of a very structured school day, the allure of technology and risk- averse parent- ing (Gray and Martin 2012; Malone 2007). In fact, forest school and play-based outdoor learning are often seen as an alternative to the overly structured day, an opportunity for children to have time to just 'be' and explore their own interests, while creating an attach- ment to the natural world (Lloyd and Gray 2010). On the other hand, a daily structure in activities, a routine for eating, sleeping and play is seen as a constructive ritual that not only positively shape children's early development, but also "provide the cultural backdrop for important processes of social reproduction" (Buchbinder et al. 2006, p. 58). This ten- sion was observed between offering unstructured time in a natural settings, and setting up structure and rituals through the day in some of the practitioners' conversations. On the one hand, the majority of practitioners freely acknowledged the importance of children's autonomy and self-determination yet, on the other hand, they also recognised that certain routines had to be in place.

Compared with conventional/indoor settings, these were often very minimal, for exam- ple, routines around getting to and from the main setting, safety, hygiene and eating. Even with these routines, autonomy was valued, with children being given the opportunity to act in a self-initiated way. A good example was the transition-in-time processes, such as moving onto snack or lunch in several of the settings. They relied on song to move from one activity to the other, seeing it as a more gentle way than telling children. In that way, the signal for transition was given, it was clear, and the children would move on when ready.

Outside meal times, the structure of the day was very loose, with the majority of sessions being reserved for child-initiated play and exploration. In fact, one would describe the day as having more of a fluid rhythm, rather than a schedule, with flexibility to encompass children's needs, wants and fascinations. The way in which the physical space was structured is a key element of autonomy support within these settings that is described below.

Structure of Space

Another interesting manifestation of structure within an autonomy supporting environment was the transition-in-space. Several settings had a 10–20 min walk from drop-off place to the main camp area. Within this walk, children were allowed to run ahead. All along the route, there were set waiting places, a log, a gate, a prominent tree. Even the youngest of children could recognise these and referred to them as the 'waiting log', etc. These spots along the way served as check-in points. While children were allowed to run on in between them, they had to stop and wait at each waiting

spot. The practice allowed autonomy within structure, while also keeping everyone safe and together on the journey into and out of the forest.

Ownership of place and place names

Key to acknowledging the children's autonomy was a sense of allowing them ownership of the place. The way in which the children spoke about 'their forest' denoted a clear sense that they belonged in that space, and that the space belonged to them. Their ease of movement across the wild spaces and the way in which they interacted and talked to each other about them was indicative of place attachment.

At most settings observed, and through discussion with practitioners, it was noted that each area of the forest had different and often very descriptive names. Two of the settings, however, described the interesting practice of letting children pick the names of the areas of the forest. Children had picked imaginative, descriptive and sometimes rather strange names for some of the areas, such as the 'Lion's Den' or 'Crane's Nest'. This practice of naming can be seen as an indicator of attachment to place (Taylor et al. 1984), and also as denoting a sense of ownership and familiarity by the children.

Hiding places and resting places

In a qualitative study of children's spaces and autonomy, Green (2013) picks out the following four activities that represent children's experience of space: playing and exploring, and hiding and resting. These two latter points are examined in this section, informed by the child–environment and child–adult interactions undertaken in this study.

The sense of spatial autonomy is never more pronounced than when children claim spaces through the building of dens. Sobel (1990) talks of the den as a special place where the 'birth of self' takes place (p. 9). Moreover, Barrable and Barrable (2017) describe the den as a place where children 'grow themselves' (p. 61). Whether pre-existing or built by children in a corner of the forest, the den becomes a place where the child is king, a place of perfect ownership.

The den might be seen by the child as a social place for children, or a hiding place (Kylin 2003), a place to escape from the adult world and be truly autonomous. That sense of control is key to the experience. Green (2015) writes:

> Through hiding, children gained control and constructed their own rules in their home environments. Hiding places also offered children a sense of comfort and secu rity and provided a space for play and creativity. Early childhood educators need to consider the significance of children's hiding places and activities as they construct their own sense of place and identity (p. 329).

Although the adult in this child–environment interaction is largely absent, and her role is one of facilitation or even observation rather than planning, it was evident from the data collection in this project that there were steps that the adults could take to encourage and support this autonomy beyond simply allowing it to happen. One of the ways observed was to provide a 'communication' space, a piece of slate for writing on to communicate whether the space/den was open to adults or not. This presented children with a unique exercise in control of their own space and rule-setting.

Several settings provided pop-up tents for the children to rest in. Older children could find these and set them up themselves, then settle in with some blankets to rest, read or play. Younger children could ask to be provided with this space, which seemed particularly popular post-lunch and on colder/wetter days.

Affordances

The term affordance refers to the functional utility of an environment to the individual (person or animal). It closely relates to the how the competencies of the individual match up with the provision in the natural environment (Gibson 1979). The affordance of nature has been seen as a key positive characteristic of nature schools (Fjørtoft 2001), as well as a particular avenue to autonomy in forest schools (Barrable and Arvanitis 2019).

In this study, one of the key observations in relation to the affordance was unsurprisingly related to the type of natural environments where the nature settings were based. In this way, the diversity of the natural environment is a central positive feature that can meet the needs of children for exploration and imaginative play; the more complex the environment, the greater the opportunities for children (Ridgers et al. 2012). Through our observations and discussions with practitioners, it was clear that different types of woodland offered diverse opportunities, through two points of divergence: biodiversity and loose parts.

Broad-leaf forests, such as birch and oak, as well as mixed or diversified forests, offered greater opportunity for play in loose parts and great biodiversity on the forest floor. Monocultures of conifers, such as the Scots pine, provided year-round shelter. Because most of these were managed plantations, there was the opportunity to leave felled trees in situ and use them to support practice. Felled trees were often used as bridges, or balance beams, and their roots offered a rich environment for play and exploration. Oaks can provide ideal trees for climbing, with the branching starting around a metre off the ground, and a sound branch structure for excellent and safe climbing.

In several settings, practitioners had taken advantage of certain features of the terrain to create opportunities for the children to engage with the natural environment in different ways. Natural springs and dry river beds were used as slides or to provide for water in a mud kitchen, while slopes and rocks presented opportunities for climbing, often facilitated by the use of ropes. The engaged practitioner responded to the children's needs by providing such aids, as well as verbal feedback.

Role of weather

The weather played a central role which is difficult to untangle from the forest environment itself. Prevailing winds or inclement conditions often dictated which spaces could or could not be used. Older and more-experienced children were empowered to make their own decisions in response to weather conditions and the practitioners worked with them to assess risk and weather. Children were able to choose their own spots, as long as they communicated clearly with practitioners when moving on. Finally, it seemed that the more inclement the weather the less likely it was for children to spread widely, and the closer they stayed to the practitioner throughout the day. From discussions with practitioners, on days with rainy weather, children became much more reliant on adult guidance for activities.

Assessing and managing risk

Taking managed risks is central to the forest school approach and is often seen as one of the desirable skills that children learn as they engage with the forest environment (O'Brien and Murray 2007).

Mastering age- and competence level- appropriate challenges can become a valuable exercise in judgement and decision making for children as young as 3 years of age (Sandseter and Kennair 2011).

While there are many types of risky play, several of them are particularly appropriate to a forest environment, such as climbing to great heights, working with sharp tools and possibility getting lost (Sandseter 2007). Therefore, it is important for both adults and children to learn how to assess risk, and set structures and rules to avoid fatal or other serious accidents.

During this project, we found that structure, as discussed above, was particularly useful when it came to managing risk. Structures around risk and dangerous activities were dis- cussed and agreed in a collaborative manner. Because informed voice was used, risks were fully explained to the children and ways to manage them were arrived at through inter- action and discussion. Thus, there was a distinct ownership of the rules by the children. While some discussions were prompted by the practitioner, others were prompted and led by the children, who then set the boundaries for themselves.

Within the group, there was a distinct sense of the group discussing and managing risk. Children found it easy to discuss potential dangers and even mitigate them amongst them- selves. For example, when climbing onto a fallen log that was used as a bridge/balance beam, one child noted that it was wet and therefore slippery, and another suggested sit- ting on it rather than standing. In this way, children remained autonomous and safe, while the small ratio of practitioners to children allowed discussions to take place and ultimately oversight of all activities. A potential factor that could have an effect on some of the atti- tudes towards risky play and risk taking that were observed could be that all practitioners interviewed were female. Past research suggests that female practitioners tend to be signifi- cantly less likely to allow risk taking behaviour and to have a more liberal attitude towards risky play (Sandseter 2014).

A few rules seemed to apply to all settings, especially when it came to tree climbing. The children were given the knowledge to make safe decisions regarding how to identify trees that were healthy, strong and therefore safe for climbing. This allowed the children the autonomy to make their own decisions regarding choosing suitable trees. Moreover, all settings had the rule that children were not to be helped to get on any trees: they would do so when they were developmentally ready. This explicit match of competence on the part of the child and level of skill on the part of the activity is linked to what is discussed in Barrable and Arvanitis (2019) as optimal challenge. By finding that balance, children are kept safe from 'misadventure', which is the term used to describe a mismatch between skill and competence (Gill 2010).

The issue of boundaries was addressed in a variety of ways in different settings, allowing for different levels of autonomy. Some settings, by the nature of their location, had natural boundaries (streams, roads, fields or other fenced-off areas). These were the clear-est ways to set boundaries. Other settings denoted boundaries by putting ribbons or tape on trees—in that way, giving children a clear indication of where the perimeter of an area was. However, upon discussion, a practitioner explained that these visible markings were only 'soft' boundaries and were used flexibly: children were aware of them but they were allowed to go past them upon informing an adult. This allowed children control of where they were at any one point, within a safe environment and with adequate supervision. Some settings had no set boundaries at all. Upon discussion with the practitioner, it became clear that children tended to stay close, while they would inform each other on what was deemed safe. Introducing new children to the setting gradually, possibly only one at a time, meant that the children themselves were able to regulate their activities safely. The support and promotion of autonomy with respect to risk and risky activities were believed to lead to greater self-regulation and a safer environment by practitioners.

Discussion

This particular project was primarily guided by the following research aims: to explore how the natural spaces are shaped by practice that is committed to supporting autonomy; and to explore how natural spaces themselves shape AS practices.

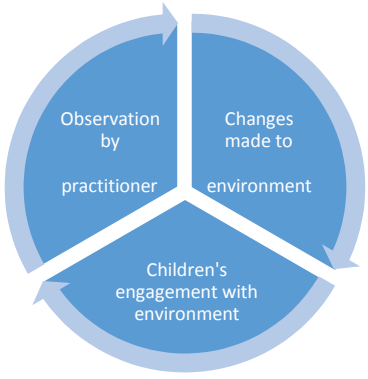
In order to explore how natural spaces are shaped by practice, it was important to understand the role of the practitioner within the natural setting as one of curator and facilitator. For that reason, an ethnographic research design was used as described in the methodology section above.

It emerged from the data collected that the expert practitioner's main role within the natural setting can often be that of an observer, and that the process of *curation* relies on the iterative process of observation, change to the environment and back to observation of the children and how they engage with the environment. This highly iterative process, which relies on clear communication between practitioner and child and skilled observation on the part of the practitioner, can inform a constant curation of the affordances present in the learning environment and is described by the cyclical shape of Fig. 1.

The simple act of skilled observation is crucial for listening to the child's needs and being responsive to them, especially for young, pre-verbal children. The effective practitioner gets to know the child and can acknowledge her internal frame of reference (Côté- Lecaldare et al. 2016). In this way, the adult can be empathic, take the child's perspective and support her need for autonomy (Grolnick et al. 1997; Kaplan and Assor 2012). Extending previous SDT research that focuses on observation as an autonomy supportive factor (Côté-Lecaldare et al. 2016), the current findings suggest that the practitioner can manipulate the physical environment, both as a response to the needs of the child and in order to provide sustained and meaningful engagement with the environment. In turn, this changes the child's self-directed response, further informing the practitioner's curation. This can be seen as a novel finding from this research.

Also emerging from the findings is the idea that a forest school setting is not a set space, but rather a continuously evolving entity. There are many influences on that entity, including both human (children and practitioner) non-human (wildlife, fauna and flora, weather). These interactions are entrenched in the pedagogy within the space and lend themselves to an autonomy supportive environment for the children that relies on child-led decisions for action, play and risk management. Moreover, children are able to have control of their environment in ways that are not often possible within an indoor setting, including

Fig. 1 Iterative process of effectively shaping the outdoor environment for autonomy



the flexibility of boundaries and the creation of private spaces, such as dens (Kylin 2003). The effect of the natural outdoor environment on engagement in early childhood has been observed before in LE research (Nedovic and Morrissey 2013) but previously has never been explored through an SDT lens. This was undertaken in this study, with autonomy being the key factor. In this sense, this research suggests that the opportunities afforded to the child for growth and self-direction are only limited by the three-way interaction, and are facilitated by the expert practitioner in the ways described above. This finding generally concurs with previous LE research that has used SDT and has focused on student outcomes, including motivation and competence, in other contexts (e.g. Alfassi 2004), but it extends past research to the less-studied forest environment and to an early- childhood focus.

Several limitations have to be acknowledged, relating to the research design and the limited sample of observations. Ethnography in itself is deeply 'personalistic' and this can in itself affect reliability of results (LeCompte and Goetz 1982, p. 36). Therefore, the researcher attempted to mitigate this by explicitly explaining both the data collection, the organising frameworks for analysis and the process of it. In terms of reliability, the con- clusions of this particular research are qualified by the researcher herself and by her role within the research sites (LeCompte and Goetz 1982). As such, they might not be applicable or generalisable on a large scale and to every forest site. Validity of findings, however, can be seen as a strength of ethnographic, especially when compared with other qualitative methodologies (Denzin 1978; LeCompte and Goetz 1982). This is mostly because of the triangulation practices, which also were undertaken in this work.

These above limitations do not preclude generalisation of these findings and the reflective practitioner is invited to critically use the recommendations below to enhance their practice. Moreover, the author hopes that the study can inform future research, which can then address some of these limitations by using supplementary methods of exploration of the concept of AS in forest settings, including the use of quantitative methodologies or experimental designs, to expand upon the findings presented in this article.

Conclusion

Creating an effective outdoor space that is need-supportive for the young child is inevitably a complex and iterative process. It relies on the practitioner having a variety of skills and it is also highly dependent on the natural affordances of the space available. This small qualitative study of settings in Scotland aimed to use SDT to describe ways in which AS is facilitated by the interaction of adult, child and environment. The following key implications for practice are suggested, as outlined in the themes emerging from this ethnographic study. Firstly, a structure, both in time and space, within which children can feel safe to enact self-directed behaviours should be created. Secondly, children should be allowed to rest and hide within the place as they wish. The right type of environment and stimuli to allow this behaviour to freely emerge need to be provided. Thirdly, ownership of space should be promoted; this could be accomplished through encouraging children to give names to places, for example. Finally, children should manage of their own risk and share information feedback on the best ways to do so, but refrain from controlling behaviours in managing potential risks.

As a more general overarching principle, this research suggests a model for shaping the environment to support autonomy. The participant's willingness to engage with the child

and with the natural environment at different levels is central, and includes closely observing and consulting with the child on a regular basis, as well facilitating opportunities in accordance with the child's competence and interests. This is a cyclical process that brings together the interaction of child, practitioner and environment and promotes an autonomy supportive environment, both in the physical and psychosocial aspects of the term.

References

ACARA. (n.d.). Retrieved February 23, 2019, from https://www.australiancurriculum.edu.au/resources/curriculum-connections/portfolios/outdoor-learning/

Alfassi, M. (2004). Effects of a learner-centred environment on the academic competence and motivation of students at risk. *Learning Environments Research, 7*(1), 1–22.

Barrable, A. (2019). Refocusing environmental education in the early years: A brief introduction to a peda- gogy for connection. *Education Sciences, 9*(1), 61.

Barrable, A., & Arvanitis, A. (2019). Flourishing in the forest: Looking at Forest School through a self- determination theory lens. *Journal of Outdoor and Environmental Education, 22*(1), 39–55. https:// doi.org/10.1007/s42322-018-0018-5.

Barrable, A., & Barrable, D. (2017). *Growing up wild: 30 great ways to get your kids outdoors*. London: Robinson.

Bernier, A., Carlson, S. M., & Whipple, N. (2010). From external regulation to self-regulation: Early parent- ing precursors of young children's executive functioning. *Child Development, 81*(1), 326– 339. https:// doi.org/10.1111/j.1467-8624.2009.01397.x.

Boellstorff, T., Nardi, B., Pearce, C., & Taylor, T. L. (2012). *Ethnography and virtual worlds: A handbook of method*. Princeton, NJ: Princeton UniversityPress.

Boggiano, A. K., Flink, C., Shields, A., Seelbach, A., & Barrett, M. (1993). Use of techniques promoting students' self-determination: Effects on students' analytic problem-solving skills. *Motivation and Emo- tion,17*(4),319–336.https://doi.org/10.1007/BF00992323.

Buchbinder, M., Longhofer, J., Barrett, T., Lawson, P., & Floersch, J. (2006). Ethnographic approaches to child care research: A review of the literature. *Journal of Early Childhood Research, 4*(1), 45– 63.

Care Inspectorate. (2018). *My world outdoors*. Retrieved April 21, 2019, from accessible online at https://hub.careinspectorate.com/how-we-support-improvement/care-inspectorate-programmes- and-publi cations/my-world-outdoors/

Cleveland, E. S., Reese, E., & Grolnick, W. S. (2007). Children's engagement and competence in personal recollection: Effects of parents' reminiscing goals. *Journal of Experimental Child Psychology, 96*(2), 131–149. https://doi.org/10.1016/j.jecp.2006.09.003.

Côté-Lecaldare, M., Joussemet, M., & Dufour, S. (2016). How to support toddlers' autonomy: A qualitative study with child care educators. *Early Education and Development, 27*(6), 822–840.

Dahl, T. I., Sethre-Hofstad, L., & Salomon, G. (2013). Intentionally designed thinking and experience spaces: What we learned at summer camp. *Learning Environments Research, 16*(1), 91–112.

Deci, E. L., Schwartz, A. J., Sheinman, L., & Ryan, R. M. (1981). An instrument to assess adults' ori- entations toward control versus autonomy with children: Reflections on intrinsic motivation and perceived competence. *Journal of Educational Psychology, 73*(5), 642–650. https://doi. org/10.1037/0022-0663.73.5.64.

Deci, E. L., & Vansteenkiste, M. (2004). Self-determination theory and basic need satisfaction: Understand- ing human development in positive psychology. *Ricerche di psicologia, 27*(1), 23– 40.

Denzin, N. K. (1978). Triangulation: A case for methodological evaluation and combination. In N. K. Den- zin (Ed.), *Sociological methods* (pp. 339–357). New York: McGraw-Hill.

Department of Education and early Childhood Development. (2017). *Outdoor education 110*, Retrieved April 26, 2019 from http://www2.gnb.ca/content/dam/gnb/Departments/ed/pdf/K12/curric/Health- PhysicalEducation/OutdoorEducation.pdf.

Doyle, J., & Milchem, K. (2012). *Developing a Forest School in early years provision.* London: Practical Pre-School Books.

Early Childhood Curriculum Framework. (2015). Retrieved May 7, 2019, from https://www.earlychildhoodi reland.ie/work/quality-practice/national-frameworks/aistear/

Erikson, E. H. (1993). *Childhood and society*. New York: WW Norton & Company.

Fjørtoft, I. (2001). The natural environment as a playground for children: The impact of outdoor play activi- ties in pre-primary school children. *Early Childhood Education Journal, 29*(2), 111–117.

Flick, U. (2004). Triangulation in qualitative research. In U. Flick, E. von Kardoff, & I. Steinke (Eds.), *A companion to qualitative research* (pp. 178–183). London: Sage.

Flink, C., Boggiano, A. K., & Barrett, M. (1990). Controlling teaching strategies: Undermining children's self-determination and performance. *Journal of Personality and Social Psychology, 59*(5), 916. https:// doi.org/10.1037/h0090387.

Frodi, A., Bridges, L., & Grolnick, W. (1985). Correlates of mastery-related behavior: A short-term longitudinal study of infants in their second year. *Child Development, 56,* 291–1298. https://doi. org/10.2307/1130244.

Gibson, J. (1979). *The ecological approach to visual perception.* Dallas: Houghton Mifflin.

Gill, T. (2010). *Nothing ventured: Balancing risks and benefits in the outdoors: English Outdoor Coun- cil.* Retrieved December 14, 2017, from https://www.englishoutdoorcouncil.org/wp- content/uploa ds/Nothing-Ventured.pdf

Gobo, G. (2008). Introducing qualitative methods: Doing ethnography. *London, : SAGE Publications Ltd.* https://doi.org/10.4135/9780857028976.

Gray, T., & Martin, P. (2012). The role and place of outdoor education in the Australian National Curricu- lum. *Journal of Outdoor and Environmental Education, 16*(1), 39–50.

Green, C. (2013). A sense of autonomy in young children's special places. *International Journal of Early Childhood Environmental Education, 1*(1), 8–31.

Green, C. (2015). "Because we like to": Young children's experiences hiding in their home environment.

Early Childhood Education Journal, 43(4), 327–336.

Grolnick, W. C., Deci, E. L., & Ryan, R. M. (1997). Internalization within the family: The self-determi- nation theory perspective. In J. E. Grusec & L. Kuczynski (Eds.), *Parenting and children's inter- nalization of values: A handbook of contemporary theory* (pp. 135–161). New York: Wiley.

Hospel, V., & Galand, B. (2016). Are both classroom autonomy support and structure equally important for students' engagement? A multilevel analysis. *Learning and Instruction, 41,* 1–10.

Jarzabkowski, P., Bednarek, R., & Lê, J. K. (2014). Producing persuasive findings: Demystifying eth- nographic textwork in strategy and organization research. *Strategic Organization, 12*(4), 274– 287.

Kaplan, H., & Assor, A. (2012). Enhancing autonomy-supportive I-Thou dialogue in schools: Conceptu- alization and socio-emotional effects of an intervention program. *Social Psychology of Education, 15,* 251–269. https://doi.org/10.1007/s11218-012-9178-2.

Knight, S. (Ed.). (2011a). *Forest school for all*. London: Sage.

Knight, S. (2011b). Forest School as a way of learning in the outdoors in the UK. *International Journal for Cross-Disciplinary Subjects in Education, 1*(1), 590–595.

Knight, S. (Ed.). (2013). *International perspectives on forest school: Natural spaces to play and learn.*

London: Sage.

Koestner, R., Ryan, R. M., Bernieri, F., & Holt, K. (1984). Setting limits on children's behavior: The dif- ferential effects of controlling vs. informational styles on intrinsic motivation and creativity. *Journal of personality, 52*(3), 233–248.

Kopp, C. B. (1982). Antecedents of self-regulation: A developmental perspective. *Developmental Psy- chology, 18*(2), 199–214. https://doi.org/10.1037/0012-1649.18.2.199.

Kylin, M. (2003). *Children's dens. Children Youth and Environments, 13*(1), 30–55.

Laurin, J. C., & Joussemet, M. (2017). Parental autonomy-supportive practices and toddlers'rule inter- nalization: A prospective observational study. *Motivation and Emotion, 41*(5), 562–575.

LeCompte, M. D., & Goetz, J. P. (1982). Problems of reliability and validity in ethnographic research.

Review of Educational Research, 52(1), 31–60.

LeCompte, M. D., & Schensul, J. J. (2010). *Designing & conducting ethnographic research: An intro- duction* (Vol. 1). Lanham, MD: Altamira.

Liu, C. J., Zandvliet, D. B., & Hou, I. L. (2012). The learning environment associated with information

technology education in Taiwan: Combining psychosocial and physical aspects. *Learning Environ- ments Research, 15*(3), 379–402.

Lloyd, A., & Gray, T. (2010). *Place-based outdoor learning and environmental sustainability within*

Australian Primary School Education, 2010. Retrieved May 18, 2019, from http://www.susted.com/wordpress/content/place-based-outdoor-learning-and-environmental-sustainability-within- austr alian-primary-school_2014_10/

Malone, K. (2007). The bubble-wrap generation: Children growing up in walled gardens. *Environmental Education Research, 13*(4), 513–527.

Maynard, T. (2007). Forest Schools in Great Britain: An initial exploration. *Contemporary Issues in Early Childhood, 8*(4), 320–331.

Natural Start Alliance. (2017). *Nature preschools and forest kindergartens: 2017 national survey.*

Retrieved February 21, 2017, from http://naturalstart.org/sites/default/files/staff/nature_preschools

_national_survey_2017.pdf

Nedovic, S., & Morrissey, A. M. (2013). Calm active and focused: Children's responses to an organic outdoor learning environment. *Learning Environments Research, 16*(2), 281–295.

O'Brien, L., & Murray, R. (2007). Forest School and its impacts on young children: Case studies in Brit- ain. *Urban Forestry & Urban Greening, 6*(4), 249–265.

O'Brien, L. (2009). Learning outdoors: The Forest School approach. *Education 3–13, 37*(1), 45–60. Peacock, A., & Pratt, N.

(2011). How young people respond to learning spaces outside school: A socio-

cultural perspective. *Learning Environments Research, 14*(1), 11–24.

Reeve, J., & Halusic, M. (2009). How K-12 teachers can put self-determination theory principles into practice. *School Field, 7*(2), 145–154.

Reeves, S., Kuper, A., & Hodges, B. D. (2008). *Qualitative research methodologies: Ethnography*. *BMJ Open, 337*, a1020.

Ridgers, N. D., Knowles, Z. R., & Sayers, J. (2012). Encouraging play in the natural environment: A child- focused case study of Forest School. *Children's Geographies, 10*(1), 49–65.

Ryan, R. M. (1993). Agency and organization: Intrinsic motivation, autonomy and the self in psychological development. In J. Jacobs (Ed.), *Nebraska symposium on motivation: Developmental perspectives on motivation* (Vol. 40, pp. 1–56). Lincoln: University of Nebraska Press.

Ryan, R. M., & Deci, E. L. (2006). Self-regulation and the problem of human autonomy: Does psychology need choice, self-determination, and will? *Journal of Personality, 74*(6), 1557–1586.

Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. New York: Guilford Press.

Ryan, R. M., & Grolnick, W. S. (1986). Origins and pawns in the classroom: Self-report and projective assessments of individual differences in children's perceptions. *Journal of Personality and Social Psy- chology, 50*(3), 550–558. https://doi.org/10.1037/0022-3514.50.3.550.

Salmi, H., & Thuneberg, H. (2018). The role of self-determination in informal and formal science learning contexts. *Learning Environments Research, 21*, 1–21.

Sandseter, E. B. (2007). Categorising risky play—How can we identify risk-taking in children's play? *Euro- pean Early Childhood Education Research Journal, 15*(2), 237–252.

Sandseter, E. B. H. (2014). Early childhood education and care practitioners' perceptions of children's risky play: Examining the influence of personality and gender. *Early Child Development and Care, 184*(3), 434–449.

Sandseter, E. B. H., & Kennair, L. E. O. (2011). Children's risky play from an evolutionary perspective: The anti-phobic effects of thrilling experiences. *Evolutionary Psychology, 9*(2), 147470491100900212.

Scottish Government. (2018). *Encouraging more men into childcare.* Retrieved November 7, 2019. Acces- sible online at https://www.gov.scot/news/encouraging-more-men-into-childcare/

Sharma-Brymer, V., Brymer, E., Gray, T., & Davids, K. (2018). Affordances guiding Forest School practice: The application of the ecological dynamics approach. *Journal of Outdoor and Environmental Educa- tion, 21*(1), 103–115.

Shavelson, R. J., & Seidel, T. (2006). Approaches in measuring learning environments. *Learning Environ- ments Research, 9*(3), 195–197.

Sobel, D. (1990). A place in the world: Adults' memories of childhood's special places. *Children's Environ- ments Quarterly, 7*(4), 5–12.

Sokol, B. W., Grouzet, F. M. E., Müller, U., Deci, E. L., & Ryan, R. M. (2013). The importance of auton- omy

for development and well-being. In B. W. Sokol, F. E. Grouzet, & U. Muller (Eds.), *Self-Regula- tion and autonomy: Social and developmental dimensions of human conduct* (pp. 19–46). Cambridge, UK: Cambridge University Press.

Tal, R. T. (2001). Incorporating field trips as science learning environment enrichment–an interpretive study. *Learning environments research, 4*(1), 25–49.

Taylor, R. B., Gottfredson, S. D., & Brower, S. (1984). Neighborhood naming as an index of attachment to place. *Population and Environment, 7*(2), 103–125.

Ulset, V., Vitaro, F., Brendgen, M., Bekkhus, M., & Borge, A. I. (2017). Time spent outdoors during pre- school: Links with children's cognitive and behavioral development. *Journal of Environmental Psy- chology, 52,* 69–80.

Vallerand, R. J., Fortier, M. S., & Guay, F. (1997). Self-determination and persistence in a real-life setting: Toward a motivational model of high school dropout.
Journal of Personality and Social Psychology, 72(5), 1161.

Vansteenkiste, M., Sierens, E., Goossens, L., Soenens, B., Dochy, F., Mouratidis, A., et al. (2012). Identify- ing configurations of perceived teacher autonomy support and structure: Associations with self-regu- lated learning, motivation and problem behavior. *Learning and Instruction, 22*(6), 431–439.

Waters, J., & Maynard, T. (2010). What's so interesting outside? A study of child-initiated interaction with teachers in the natural outdoor environment. *European Early Childhood Education Research Journal, 18*(4), 473–483.

Waxman, H. C., & Huang, S. L. (1996). Motivation and learning environment differences between resilient and nonresilient inner-city middle school students. *Journal of Educational Research, 90,* 93–102.

Waxman, H. C., & Huang, S. L. (1997). Classroom instruction and learning environment differences between effective and ineffective urban elementary schools for African American students. *Urban Education, 32*(1), 7–44.

Waxman, H. C., Huang, S. L., Anderson, L., & Weinstein, T. (1997). Investigating classroom processes in effective/efficient and ineffective/inefficient urban elementary schools. *Journal of Educational Research, 91,* 49–59.

Waxman, H. C., Huang, S. L., Knight, S. L., & Owens, E. W. (1992). Investigating the effects of the class- room learning environment on the academic achievement of at-risk students. In H. C. Waxman & C.

D. Ellett (Eds.), *The study of learning environments* (Vol. 5, pp. 92–100). Houston, TX: University of Houston.

Wijnen, M., Loyens, S. M., Wijnia, L., Smeets, G., Kroeze, M. J., & Van der Molen, H. T. (2018). Is prob- lem-based learning associated with students' motivation? A quantitative and qualitative study. *Learn- ing Environments Research, 21*(2), 173–193.

Wilson, C. E. (2006). Triangulation: The explicit use of multiple methods, measures, and approaches for determining core issues in product development.
Interactions, 13(6), 46.

Wurdinger, S., & Paxton, T. (2003). Using multiple levels of experience to promote autonomy in adventure education students. *Journal of Adventure Education & Outdoor Learning, 3*(1), 41–48.

Zaragoza, J. M., & Fraser, B. J. (2017). Field-study science classrooms as positive and enjoyable learning environments. *Learning Environments Research, 20*(1), 1–20.

Appendix iv b

Supporting Autonomy in Nature Settings

Structure

It may seem strange, but having a structure and clearly communicating expectations can increase feelings of autonomy in children.

Display the day's schedule on a chalkboard for all to see!

Promote ownership of space

Create opportunities for connection to the place by giving groups the chance to name their surroundings.

Allow children to make signs for these locations.

Hiding and resting

Allowing children to hide and rest as they feel, by providing the right type of spaces .

Use pop up tents that can be accessed by children!

Managing risk

Let children be part (or even lead) the risk assessment process.

Offer instructional feedback (i.e. 'how to') and focus on what children can already do!

Barrable, A., (2019) Shaping space and practice to support autonomy: Lessons from natural settings in Scotland, Learning Environments Research

Appendix v

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Nature relatedness in student teachers, perceived competence and willingness to teach outdoors: an empirical study

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Nature relatedness in student teachers, perceived competence and willingness to teach outdoors: An empirical study

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Abstract

Despite a drive towards more learning outside the classroom, teachers' confidence to teach outdoors has been identified as a barrier to regular and positive outdoor experiences. Initial Teacher Education (ITE) has been seen as one of the ways to increase teachers' confidence, yet such provision is variable and has not been studied extensively. In this study we explore how a practical outdoor session can increase motivation to teach outdoors. Moreover, using a Self-Determination Theory framework we hypothesise that increased nature relatedness would be associated with higher perceived competence and willingness to teach outdoors. Forty-nine ITE students took part in the outdoor session, and responded to pre- and post-measures of nature relatedness, perceived competence and willingness to teach outdoors. Results suggest a positive correlation between nature relatedness and both perceived competence and willingness to undertake outdoor sessions. Moreover, nature relatedness was significantly higher after the outdoor environmental education session.

Keywords: teacher education, outdoor learning, nature relatedness, Self-Determination Theory

Introduction

Recent studies coming out of Scotland, as well as a wealth of international research, have highlighted the benefits of well-structured, quality outdoor learning experiences for children of all ages (Higgins & Nicol, 2013; Malone, 2008; Mannion, Mattu & Wilson, 2015; Pretty et al, 2009). The benefits include increased physical activity (Brown et al., 2009; Henderson, Grode, O'Connell & Schwartz, 2015; Schlechter, Rosenkranz, Fees & Dzewaltowski, 2017), and the development of a host of cognitive, non-cognitive, emotional, behavioural and social skills (Malone, 2008). A recent longitudinal, large scale study, for example, of children attending Norwegian day care centres suggests that there is a positive relationship between hours spent outdoors in preschool and several desirable cognitive and behavioural outcomes (Ulset, Vitaro, Brendgen, Bekkhus & Borge, 2017). Another study from Scotland, looked at the benefits of adventure education on social and personal skills (Scrutton, 2015). Results showed a small positive benefit post experience, but little retention after 10 weeks, thereby highlighting the importance of integration of such experiences in general teaching.

The type of environment children have access to is also important. Natural environments, for example, have been found to have positive effects on attention and could possibly be used as a preventative tool against Attention Deficit Hyperactivity Disorder (ADHD; Faber Taylor and Kuo, 2011) as well as to positive influence executive functions (Bourrier, Berman, & Enns, 2018). Moreover, regular access to green spaces in adults has been linked with increased physical and psychological well-being (Ruimtelijk, 2004), while access in childhood has been found to be associated with better psychological outcomes in adulthood (Engemann et al., 2019). A systematic literature review by Gill (2014) into the benefits of children's engagement with

nature brings forth several interesting messages, that are well supported by the literature. These include pro-environmental attitudes in adulthood for those who spent more time outdoors as children (Chawla, 1999; Ewert, Place & Sibthorp, 2005; Wells & Lekies, 2006), and that spending time in nature is associated with better mental health and emotional regulation (Korpela, Kyttä, Hartig, 2002). In his review, Gill (2014) highlights other claims with some support within the literature, such as specific types of engagement, like gardening, or forest-school being associated with benefits, such as increased self-esteem. Finally, a more recent review of the literature attempted to identify the role of experiences in nature in promoting learning (Kuo, Barnes & Jordan, 2019). The report finds strong evidence, including experimental evidence, to support the role of nature and proposes several mechanisms for this. These include increased attention and reduced stress, better self-discipline as well as increased interest and enjoyment of learning (Kuo et al., 2019).

While outdoor learning and teaching in natural settings has come to be seen as an important part of practice and policy in both Scotland (Christie, Higgins and Nicol, 2015) and the rest of the UK (Ofsted, 2008), Scotland, is considered to be one of the pioneering countries in the formalisation of outdoor education provision (Higgins, 2002). This has continued, with outdoor learning having a valued place within Curriculum for Excellence (CfE; Education Scotland, n.d.). In late 2018 guidance was published by the Scottish Government on the ways that meaningful outdoor learning experiences could be created, further encouraging practitioners to use the outdoors (Scottish Government, 2018) However, there is no longer a statutory requirement for schools and teachers to provide such experiences, and much still depends on the setting and practitioner’s willingness to undertake such teaching and learning experiences (Beames, Atencio & Ross, 2009). While barriers often include cost and accessibility of

appropriate spaces, evidence from the rest of the UK suggests that another key barrier can be the teachers' confidence[2] in their ability to plan and deliver such experiences (Nundy, Dillon & Dowd, 2009; O'Donnell, Morris & Wilson, 2006).

Increasing training opportunities for teachers would aid in equipping them with the necessary knowledge, skill and understanding to plan and safely undertake positive outdoor learning experiences. A similar call has been made in the US, relating to environmental education (EE) within teacher education (Franzen, 2017). In this regard Initial Teacher Education (ITE) programmes have been identified as a key way to build such skills and confidence in student teachers (University of Edinburgh, 2016), alongside other opportunities such as continuous professional development. Moreover, the same report from the University of Edinburgh (2016) emphasises the need for providers to "establish a research informed approach to such provision" (p. 3). However, such provision of outdoor learning experiences as part of university-based ITE is not a requirement for programmes in Scotland, or the rest of the UK. This study aims to examine the effectiveness of this type of provision of outdoor learning experiences, in relation to increasing student teachers' and perceived competence and motivation to teach outdoors. Furthermore, this study is an attempt to further add to the research-based approach to teacher education, and in particular with regards to outdoor learning.

One of the oft-stated aims of learning outdoors in natural environments is to gain a deeper understanding of issues relating to sustainability (Higgins, 2009; Higgins & Kirk, 2006; Irwin, 2008). This is because positive outdoor experiences are perceived as helping to build a

[2] The word 'confidence' is used here, as it is the term that is used in the outdoor learning literature cited. However, in the rest of the article, the more precise term, and construct within Self-Determination Theory of, 'perceived competence' will be used. Perceived competence is the subjective understanding of one's skills, whether the individual feels they have the attributes and skills necessary in order to success in a specific task or situation (Kremer, Moran, Walker & Craig, 2011).

constructive relationship with our environment and nature, which is key to fully understanding and enacting sustainability (Palmer & Suggate, 1996). Our affective relationship with nature, rather than knowledge alone, has been linked to pro-environmental behaviours and attitudes (Nisbet, Zelenski & Murphy, 2009) with a recent study suggesting that it is in fact our connection to nature rather than knowledge of nature that is stronger associations with ecological behaviour (Otto & Pensini, 2017). Because of the relationship between nature connection and our sustainability beliefs and behaviours, nature connectedness has been recognised as an important goal of environmental education programmes (Frantz & Mayer, 2014). Moreover, it has further been identified as a central aim of

of outdoor learning (Barrable & Arvanitis, 2018).

By focusing on a pedagogy for nature connection in outdoor learning, we are strengthening the link between outdoor learning and learning for sustainability. Given the relationship between nature connection and several desirable cognitive and behavioural aspects, as demonstrated by previous studies (Kals, Schumacher & Montada, 1999; Nisbet et al., 2009; Mayer & Frantz, 2004) we can bring forward the hypotheses that nature relatedness would correlate positively with student teachers' perceived competence and willingness to teach outdoors.

There has been a call for literature that examines the type of experiences that lead to increases in relatedness with nature (Zylstra, Knight, Esler & Grange, 2014). In this context two types of routes have emerged: one relating to direct experience and contact with nature, and one relating to gaining information about nature. Actual contact, in the form of being outdoors in natural environments, has been found to have a strong association with nature relatedness (Arbuthnott, Sutter & Heidt, 2014; Hinds & Sparks, 2008; Kals et al., 1999). In one study, simply taking a short walk (15 mins) in nature was found to increase connection to nature in adults significantly

more than an urban walk or virtual exposure to nature (Mayer, Frantz, Bruehlman-Senecal & Dolliver, 2009). On the other hand, learning about nature and the environment, e.g. through environmental education projects, has also been found to have an effect on how connected we feel to nature in adults and older children (Arbuthnott et al., 2014; Ernst & Theimer, 2011; Mace, Woody & Berg, 2012). However, it should be noted that although there may be short-term increases in our nature relatedness after environmental education programmes, these may not be sustainable. In a 2013 study of both children and adults who took part in an Environmental Education programme, while there was a robust increase of connection to nature in both, at a four-week follow up, only children seemed to sustain this increase (Liefländer, Fröhlich, Bogner, & Schultz, 2013).

Theoretical framework

Self-Determination Theory (SDT) is an organismic theory of human growth and motivation (Ryan & Deci, 2017). SDT posits that humans have three innate basic psychological needs: autonomy, competence and relatedness (Deci & Ryan, 2000). Autonomy relates to humans' need to feel that they are determining their own behaviour (Ryan & Deci, 2006). Competence is the basic psychological need of humans to feel that they are achieving mastery (Adams, Little & Ryan, 2017). Finally, relatedness is our need to feel connected to others and part of a greater social context (Deci, Ryan & Guay, 2013). These three needs are closely interconnected, as well as associated with our personal motivation (Deci & Ryan, 2000).

Although SDT has been used extensively in educational contexts, the focus has been on the motivation of pupils to learn (Deci, Vallerand, Pelletier & Ryan, 1991; Grolnick & Ryan, 1987) teachers' motivation has not been studied as closely. A recent qualitative study has used SDT to look at teachers' motivation in teaching outdoors (Barfod, 2018) which placed great emphasis on

both teachers' decision making (autonomy) and the social relatedness of teachers, through building of professional networks. The study by Barfod (2018) further highlighted the importance of social relatedness as a contributing factor to increased motivation in relation to outdoor learning. Building on that study, our own work aims to look at motivation for teaching outdoors using the same framework but a quantitative methodology. Moreover, we aim to further expand the construct of relatedness past social relatedness, and include nature relatedness, the extent to which an individual feels close to nature, as an additional variable. We hypothesised that feeling closer to nature, i.e. a higher degree of nature relatedness, would be correlated with student teachers' motivation to undertake activities outdoors, mirroring Barfod's findings of higher degrees of social relatedness increasing such motivation. Moreover, NR has in the fact been associated with behavioural aspects of wanting to spend more time in nature, as well as being interested in natural processes, and wanting to protect it (Nisbet et al., 2009).

The second psychological need that the study aims to address is that of competence. Competence is explained as one's feeling of being able to tackle the challenges that are presented to them (Niemic & Ryan, 2009). An association between perceived competence and motivation has been observed before (Jaakkola, Washington, & Yli-Piipari, 2013) suggesting that the more competent someone feels to undertake a task, the more likely they are to be willing to do so. Change of behaviour within SDT has been observed to occur as a function of two processes: the internalisation of autonomy (i.e. the person feels the behaviour is self-determined, driven by the self) and competence (Williams et al., 2006). Through a subjective improvement of a particular skillset perceived competence can increase, and with it the motivation to undertake similar tasks.

In this study we focused on NR, perceived competence and willingness to teach outdoors. Given the associations between time spent outdoors, and nature relatedness (Nisbet et al., 2009) and past studies that have shown outdoor environmental education programmes can increase nature connection (Ernst & Theimer, 2011), we hypothesised that such a session would significantly increase the participants' subjective feelings of being connected to nature, as measured using the Nature Relatedness (NR) scale (Nisbet et al, 2009). Moreover, familiarising students with and modelling activities that could be performed outdoors, we proposed that students' perceived competence and willingness to teach outdoors would also increase.

Hypotheses:

For this research paper we are making the following hypotheses:

1) There is a correlation between nature relatedness and perceived competence to teach effectively outdoors.
2) There is a correlation between nature relatedness and willingness to teach outdoors.
3) There is an increase in nature relatedness after the outdoor environmental education session.
4) There is an increase in perceived competence to teach outdoors after the outdoor environmental education session.
5) There is an increase in willingness to teach outdoors after the outdoor environmental education session.

Method

Participants

A total of *n*=49 participants, who were all student teachers on the primary undergraduate or postgraduate programme, took part in the study. Two groups of participants were recruited, both of which were student teachers. All participants took part in an outdoor session. The first group (*n*=34) consisted of second year undergraduates on a four year teacher education programme (MA Hons). While the entire year group were invited to participate (*n*=61), only 34 students (55.74%) participated in both the pre- and post-session measure. The second participant group consisted of student teachers taking an Environmental Sciences elective as part of their one-year postgraduate primary education programme (PGDE) at the same university. Of the 17 students who took part in the elective (*n*=15) 88.24% responded in both the pre- and post-session questionnaires. For the collective participants (*n*=49), 83.7% were female (*n*=41) which presents a close representation of the male/female ratio for the teacher education programmes overall, which is 1/10. The mean age of all participants was 24 years (SD=7.04), with a range of 19 to 47 years. Although all 49 student teachers took the pre-session questionnaire, only 43 returned for the post-session presenting an attrition rate of 12%.

Participants were recruited via the university email system, although there was also a verbal invitation extended by both researchers during their direct contact with the students. A reminder email was sent before the outdoor session took place, and two reminders were sent post-session. Email was used in order to get maximum response (Lonsdale, Hodge & Rose, 2006), as well as for cost purposes.

The session

The outdoor sessions took place at the local Botanic Garden which is frequently used by neighbouring schools, both primary and to a lesser extent, secondary. It has an education officer and a well-resourced education programme. The aim of the session was two-fold:

(i) to introduce ITE students to the educational facilities and opportunities afforded by the Garden with a view to enabling the students to appreciate the potential such a resource offers to outdoor learning,

(ii) for the students to partake in two hands-on activities, thereby experiencing for themselves the potential of outdoor learning, whilst appreciating the various organisational practicalities that need to be considered from a teaching perspective.

The session began with a brief overview of the facilities and resources available by the Education Officer. He explained the nature of one activity the students were to undertake: ‘Plants for people trail’. The students were to put themselves in the role of the children, exploring the garden through the guidance and instruction of this education initiative.

The second activity involved the students contributing to some on-going research undertaken in the Garden on the diversity and composition of the two non-native ponds. This entailed carrying out some pond-dipping; itself a highly motivating activity (Lakin, 2013). Before embarking on the activities, a detailed discussion developed on managerial logistics, health and safety precautions and assessments, as well as opportunities for learning and the role of the teacher in guiding and scaffolding the process.

The whole session took three teaching periods (180 minutes) and concluded with a plenary encouraging the students to recount and externalise their own learning throughout from the perspective of both teacher and student. They were also encouraged to consider feelings and emotions encountered especially in terms of ‘equableness of opportunity’ from the recipient’s perspective of the experience and possible consequences this may present in terms of behaviour and contribution.

Ethics

Full ethical approval was obtained prior to the start of the data collection, from the University of Dundee School of Education and Social Work ethics committee and in accordance with University non-clinical research ethics procedures. Informed consent was sought and freely given by all participants before the commencement of data collection.

Measures

The following variables were operationalised for this study: nature relatedness, perceived competence to teach outdoors and willingness to teach outdoors. In addition, a series of other questions were included, such as gender and age, course currently enrolled in, previous outdoor teaching experience, and hours spent outdoors per week. The latter two questions had an open response box for free text. The question relating to experience of teaching outdoors had a further clarification, urging student teachers to include experience they might have had during their university teaching placements and/or as camp leaders etc.

Nature relatedness

There are many validated scales that measure nature relatedness as a construct, including the Nature Relatedness scale (NR; Nisbet et al, 2009), the Connectedness to Nature Scale (CNS; Mayer & McPherson-Frantz, 2004) and the Inclusion of Self in Nature (INS; Schultz, 2002). Of those we chose to use the NR scale, which has been used in the past to measure nature relatedness both as a trait and state level (Lumber, Richardson & Sheffield, 2017). It is correlated with time spent outdoors (Nisbet et al, 2009), and has also been used to measure changes in the subjective feeling of being connected to nature after an experience (Lumber et al, 2017). The full

scale, of 21 items, contains three subscales of self, experience and perspective. Items consist of statements e.g.

- ‘I am aware of environmental issues’
- ‘I am not separate from nature, but a part of nature’, and
- ‘ I enjoy being outdoors, even in unpleasant weather’

Responses are measured on a 5-Likert scale ranging from [1] ‘disagree strongly’ to [5] ‘agree strongly’. Finally, it has good internal consistency (α=.87).

Perceived Competence Scale

The Perceived Competence Scale (PCS) is a family of short, 4-item questionnaires designed to assess how competent a person perceives themselves to be in relation to a particular behaviour, such as learning course (PCS for Learning) materials or participating in physical activity. For the purposes of our study, we constructed a scale by adapting the PCS for Learning (Williams & Deci, 1996). The scale has four items e.g.

- ‘I feel confident in my ability to learn this material’ and,
- ‘I feel able to meet the challenge of performing well in this course’

All four items were adapted to apply to teaching outdoors e.g. ‘I feel confident in my ability to deliver quality outdoor learning experiences’ and ‘I feel able to meet the challenge of delivering meaningful lessons in nature’. We called the new scale Perceived Competence to teach Outdoors (PCTO).

The responses are given in a 7-point Likert scale ranging from [1] -not at all true’ to [7] -very true’. The PCS for Learning has a high internal consistency with an alpha measure of .80 (Williams & Deci, 1996).

Willingness to Teach Outdoors (WTO)

In order to see whether the outdoor session had an effect on student teachers' willingness to plan and deliver outdoor teaching activities, we created a 3-item scale that pertained to the likelihood that they would incorporate outdoor experiences into their learning. The first item related to general outdoor activities ('I will be incorporating outdoor learning experiences into my teaching'), while the other two were specific to Science Technology Engineering and Mathematics (STEM) subjects ('I will be teaching STEM-related subjects outside') and other curriculum subjects ('I will be planning and delivering outdoor learning experiences for other subjects within the curriculum'). The inclusion of a question particular to STEM aimed at elucidating whether receiving a science-based input would make a difference to student teachers' willingness to teach such subjects outdoors. Moreover, student teachers in Scotland have been reported as finding STEM subjects more challenging to teach (Education Scotland, 2013). To keep the format consistent with the previous question we kept the answer as a 7-Likert scale ranging from [1]-rarely' to [7]-Very often').

Analysis

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 22.0. Initially descriptive statistics were calculated and are presented below. As the data were initially explored using the Shapiro Wilk test of normality, NR was found to not be normally distributed (p=.003). Perceived Competence had a normal distribution (p=.849), while Willingness to Teach Outdoors was not normally distributed (p= .006). For that reason, non-parametric tests were used for all analyses that included NR and WTO. In order to investigate whether there is a correlation between NR and firstly, PCTO and then WTO, Spearman's rho test was performed. To determine whether there was a statistically significant change in the means

between our pre- and post-session measures for NR and WTO, we performed the Wilcoxon Signed Ranks Test, as the sample was paired and the data not normally distributed. All p-values were two-tailed. Finally, in order to calculate whether there is a significant change between the pre- and post-session values for Perceived Competence we used a paired t-test and calculated the effect size using Cohen's *d*.

Results

Descriptive statistics

The total mean NR of the whole sample (*n*=49) was calculated at M=3.56 (SD=.70). The means for males (*n*=8) and females (*n*=41) were also calculated, with males having a mean of M=4.24 (SD=.31) and females M=3.48 (SD=.67). A *t* score was not calculated for this difference, as the number of males was too small. However, an independent samples t-test was used, in order to see whether there was a significant difference between undergraduate students, on the four year ITE programme, and students on the postgraduate, one-year course. There was a significant difference between the mean in the undergraduate cohort (M=3.42, SD=.71) and their postgraduate peers (M=4.02, SD=.36); *t* (47)=-3.12, *p*=.003. Looking at the qualitative data that they provided, in terms of previous experience, 20 out of 39 MA students (51.3%) reported having some prior relevant experience, while 8 out of 17 PGDE (47%) students reported having similar. The rest of the cohort either answered 'No' or provided no answer. The experiences that were included were having been a scout or camp leader, as well as outdoor learning experiences during placement.

The mean for PCTO was calculated at M=3.46 (SD=1.19), while the respective means for males and females were, for males M=3.68 (SD=.94) and for females M=3.41 (SD=1.25). The mean for undergraduates (M=3.31, SD=.20) and postgraduates (M=3.8. SD=1.21) was also calculated, as well as the difference between the means using an independent samples t-test (t (47)=-1.31, p=.19). The difference was not found to be significant.

For WTO the mean was calculated at M=3.36 (SD=1.57). Means for males (M= and females (M= were calculated, as well as for different cohorts. The undergraduate mean was 3.10 (SD=1.51), while the postgraduate was M=3.96 (SD=1.59). The difference was not found to be significant (t (47)=-1.80, p=.08).

Finally, while looking at the descriptive statistics, we looked at whether there was a correlation between time spent outdoors and reported NR. Spearman's rho correlation coefficient was calculated at r=.45, p=.001, suggesting that, as previous research has shown there is a positive correlation between these two variables.

Internal consistency measures for the scales

Cronbach's alpha scores were calculated for the NR and the PCTO used in this study. The internal consistency for the NR in this study was very high, at α=.88. For the adapted PCTO scale used in this study Cronbach's alpha was calculated at α=.78. Both rates are generally acceptable, being above α=.70 (Cortina, 1993). Cronbach's alpha was not calculated for the WTO, because was not judged to be a relevant measure for this scale, as the WTO is not uni-dimensional.

Inferential Statistics

NR and perceived competence and willingness to teach outdoors

The first two hypotheses looked at the relationship between NR and the student teachers' perceived competence and willingness to teach outdoors.

To examine hypotheses 1 and 2 Spearman's rho correlations were performed. A significant positive correlation of r (47)=.34, p=.018 indicates that there is a positive association between student teachers' NR and their perceived competence to teach outdoors. Similar results were found when looking at NR and student teachers' willingness to undertake outdoor teaching activities, with a significant positive correlation of r (47)=.40, p=.005 between NR and reported willingness.

Changes in NR before and after session

Hypothesis 3 stated that there will be a positive change in NR after an outdoor environmental education session. The mean NR score before the session was M=3.56 (SD=.70). Post-session results for NR has a mean of M=3.66 (SD=.71). As the NR data were explored and found to not be normally distributed a Wilcoxon Signed Ranks Test was performed. It indicated that NR was significantly higher after the outdoor session than before (Z=3.45, p=.001). The null hypothesis can be rejected.

Changes in perceived competence before and after session

The fourth hypothesis predicted that there would be a positive change in student teachers' perceived competence to teach outdoors between the pre and the post-session measures. A paired samples t-test was performed, followed by a Cohen's D to measure effect size. For this question we report both the mean score, as well as the individual question scores, giving us an idea of

which areas of instruction and planning were most affected by the session that was delivered. The results are presented for each question, as well as for the total score, in Table 1 below.

Insert Table 1 about here.

Results showed that there was a significant change between pre- and post-session measurements of perceived competence to teach outdoors for three out of the four questions, as well as overall.

Changes in willingness to teach outdoors before and after session

The final hypothesis stated that there would be a positive change between students' willingness to teach outdoors before and after the session. Given the fact that the data were not normally distributed, the Wilcoxon Signed Ranks Test was used in this instance. The results are presented in Table 2 below, by question and include the total.

Insert Table 2 about here.

Discussion

Our results indicate that there is a positive correlation between how close student teachers feel to nature (NR) and how competent they perceive themselves to be in undertaking outdoor teaching sessions. In addition, NR is also positively correlated to their willingness to teach outdoors. The outdoor environmental session that our respondents engaged in had a significant positive effect on their NR. There was also a robust increase in participants' perceived competence and willingness to teach outdoors, as measured in this study.

More specifically, we had hypothesised that, given the cognitive and behavioural correlates of NR, for example spending more hours outdoors and valuing the environment (Nisbet et al,

2009), student teachers with higher NR would feel a closeness to the environment and greater ease with being outdoors. This would be likely to affect how willing they would be to undertake outdoor learning sessions.

The study found significant differences between the two cohorts that took part, the second year undergraduate students completing the four-year MA programme, and the postgraduate one-year students. The latter were found to have a significantly higher NR, which is possibly due to the fact that the PG cohort were recruited from an Environmental Scienceselective, and are therefore more likely to have an interest in environmental issues and nature. This study also found a positive correlation between time spent outdoors and NR, as would have been expected from previous literature that links these two variables (Nisbet et al, 2009). As mentioned above, no significance difference was found between prior experiences with outdoor learning in the undergraduate and postgraduate groups, that would explain a possible difference in the scores.

Previous studies have indicated that limited training is a barrier to teacher confidence to undertake outdoor sessions (Hanna, 1992), and that further training could be critical in building such confidence (O'Donnell et al., 2006; Lakin, 2013). The present study further supports that and indicates that even short (three-hour) outdoor sessions could have an effect on student teachers' perceived competence in taking their pupils out of the classroom. An interesting anomaly should be mentioned here: although student teachers' Perceived Competence to Teach Outdoors on the whole significantly improved between before and after participating in the outdoor session, although one item in particular showed no significant change. In response to statement "I am confident in my ability to deliver outdoor experiences", although scores improved between pre and post measurements, they were not significantly different. We hypothesise this might be to do with the particular phraseology used in this question, and

potential with the use of the word ‘confident’. In future, alternative wording could be provided, using the words ‘able’ or ‘capable’. The rest of the statements, which were similar all showed a significant difference between the two points in time.

The study also found that students’ willingness to teach outdoors significantly changed after their participation in the outdoor experience. However, in this case there was an exception that is worth mentioning. For item 2 (“I will be teaching STEM through outdoor learning”) there was no significant (p=.852) change recorded between pre- and post-experience measurements. We can only hypothesise that, although student teachers’ general willingness to take their classes outdoors, as well as their willingness to teach other curricular subjects increased, the prospect of teaching STEM related outdoor sessions may appear more daunting. This is likely to be related to a lack of confidence and general reticence of teachers to teach STEM subjects (Education Scotland, 2013). More focused research could illuminate this point further.

Several limitations need to be considered at this stage. A more robust study design that included a control group would have been good in increasing the reliability of the study, but was not possible in the current one. However, the fact that we can compare pre- and post-activity in a within samples design can offer evidence that the changes seen in the measurements taken before and after are indeed due to the experience, rather than an inherent difference in the sample chosen.

Although we acknowledge a bias in the sampling of the postgraduate cohort, as these were students who had actively elected to take part in a module on the teaching of Environmental Sciences. The module outline indicated that a workshop session at the Botanic Gardens was a compulsory part of the course. The differences in NR between that group and the undergraduate cohort were examined above and were found to be significant, suggesting that the students who

had chosen the elective were perhaps already positively predisposed towards outdoor learning than the average student teacher. However, the changes between before and after measurements were significant, suggesting that regardless of initial level of NR in students teachers and predisposition to teach outdoors, the experiential session could have a positive effect. Finally, a follow-up of participants, i.e. retaking the measures, after a period of 4 to 6 weeks, could further indicate whether the changes observed in NR, perceived competence and willingness to teach outdoors between pre- and post-session persisted over time. Future studies could follow participants into their school placements, to see if there were observable differences in the actual incidence of outdoor teaching between teachers who had undertaken such practical sessions, and teachers who had no such experience.

Conclusion

With a greater movetowards outdoor learning for all and the need for environmentally-responsible citizenship to be developed, good quality, positive outdoor experiences are crucial Education Scotland, n.d.). However, outdoor education provision in teacher education programmes in higher education has not been studied widely to date. The experiences provided by initial teacher education institutions vary widely in both quality and quantity, as well as in mode of teaching (Stevenson, Brody, Dillon & Wals, 2013).

In the current study we aimed to investigate one such learning experience and evaluate its efficacy. Moreover, we wanted to explore nature relatedness, a positive construct that is not only associated with increased well-being and pro-environmental beliefs, but also with behavioural elements, such as spending more time outdoors and acting in an environmentally responsible way (Nesbit et al, 2009, Capaldiet al., , 2014). Nature relatedness has further been identified as a worthwhile aim for outdoor learning experiences and programmes (Barrable & Arvanitis, 2018),

and has also been used a possible metric of success in outdoor sessions that aim to encourage people to come closer to nature and perhaps change their attitudes and behaviour towards the environment (Ernst & Theimer, 2011).

Although the authors acknowledge that more research is needed into the types of experiences that can build teachers' perceived competence in delivering diverse outdoor experiences of high quality, this study suggests that outdoor sessions, that encompass practical and pedagogic elements of environmental education could be useful in empowering teachers to take their classes outdoors. Moreover, the present study adds to the literature both in theoretical and practical terms. In terms of theory, it proposes a positive association between nature relatedness in student teachers and their perceived competence and motivation to take teaching outdoors. In terms of practice, this should encourage ITE programmes in future to see nature relatedness as a way to nurture teachers' passion for outdoor learning and the outdoors.

References

Adams, N., Little, T. D., & Ryan, R. M. (2017). Self-Determination Theory. In M. L. Wehmeyer, K. A. Shogren, T. D. Little, & S. J. Lopez (Eds.), *Development of Self-Determination Through the Life-Course* (pp. 47–54). Dordrecht: Springer Netherlands.

Arbuthnot, K. D., Sutter, G. C., & Heidt, C. T. (2014). Natural history museums, parks, and connection with nature. *Museum Management and Curatorship*, *29*(2), 102-121.

Barfod, K. S. (2018). Maintaining mastery but feeling professionally isolated: experienced teachers' perceptions of teaching outside the classroom. *Journal of Adventure Education and Outdoor Learning*, *18*(3), 201-213.

Barrable, A., & Arvanitis, A. (2018). Flourishing in the forest: looking at Forest School through a self-determination theory lens. *Journal of Outdoor and Environmental Education*, 1-17.

Beames, S., Atencio, M. & Ross, H. (2009) Taking Excellence Outdoors, *Scottish Educational Review, 41* (2), 32-45

Brown, W. H., Pfeiffer, K. A., McIver, K. L., Dowda, M., Addy, C. L., & Pate, R. R. (2009). Social and environmental factors associated with preschoolers' nonsedentary physical activity. *Child Development*, *80*(1), 45-58, doi:10.1111/j.1467-8624.2008.01245.x.

Bourrier, S. C., Berman, M. G., & Enns, J. T. (2018). Cognitive Strategies and Natural Environments Interact in Influencing Executive Function. *Frontiers in psychology*, 9.

Capaldi, C. A., Dopko, R. L., & Zelenski, J. M. (2014). The relationship between nature connectedness and happiness: a meta-analysis. *Frontiers in Psychology*, *5*, 976.

Christie B., Higgins P. & Nicol R., (2015) in Prince, H., Humberstone, B., & Henderson, K. A. (Ed.), (2015). *Routledge international handbook of outdoor studies*, Routledge: London

Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. *Journal of applied psychology*, 78(1), 98.Deci, E. L., Vallerand, R. J., Pelletier, L. G., & Ryan, R. M. (1991). Motivation and education: The self-determination perspective. *Educational Psychologist, 26*(3-4), 325-346.

Deci, E. L., & Ryan, R. M. (2000). The" what" and" why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, *11*(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01.

Deci, E. L., Ryan, R. M., & Guay, F. (2013). *Self-determination theory and actualization of human potential*. In D. McInerney, H. Marsh, R. Craven, & F. Guay (Eds.), *Theory driving research: New wave perspectives on self processes and human development* (pp. 109–133). Charlotte, NC: Information Age Press.

Education Scotland, (n.d.), *Outdoor Learning: Practical guidance, ideas and support for teachers and practitioners in Scotland* https://education.gov.scot/improvement/documents/hwb24-ol-support.pdf

Education Scotland, (2013) *3-18 Science Report* https://education.gov.scot/improvement/sci14sciencescurriculumimpact

Engemann, K., Pedersen, C. B., Arge, L., Tsirogiannis, C., Mortensen, P. B., & Svenning, J. C. (2019). Residential green space in childhood is associated with lower risk of psychiatric disorders from adolescence into adulthood. *Proceedings of the National Academy of Sciences, 201807504.* Available here https://www.pnas.org/content/early/2019/02/26/1807504116

Ernst, J., & Theimer, S. (2011). Evaluating the effects of environmental education programming on connectedness to nature. *Environmental Education Research*, *17*(5), 577-598.

Faber Taylor, A., & Kuo, F. E. (2009). Children with attention deficits concentrate better after walk in the park. *Journal of Attention Disorders, 12*(5), 402-409.

Faber Taylor, A., & Kuo, F. E. (2011). Could Exposure to Everyday Green Spaces Help Treat ADHD? Evidence from Children's Play Settings. *Applied Psychology: Health and Well-Being, 3*(3), 281-303, doi:10.1111/j.1758-0854.2011.01052.x.

Franzen, Rebecca. (2018). Environmental education in teacher education programs: Incorporation and use of professional guidelines. *Journal of Sustainability Education, 16*

Frantz, C. M., & Mayer, F. S. (2014). The importance of connection to nature in assessing environmental education programs. *Studies in Educational Evaluation, 41*, 85-89.

Gill, T. (2014). The benefits of children's engagement with nature: A systematic literature review. *Children Youth and Environments*, *24*(2), 10-34.

Grolnick, W. S., & Ryan, R. M. (1987). Autonomy in children's learning: An experimental and individual difference investigation. *Journal of Personality and Social Psychology*, *52*(5), 890. https://doi.org/10.1037/0022-3514.52.5.890.

Hanna, G. (1992). *Jumping deadfall: Overcoming barriers to implementing outdoor and environmental education.* Paper presented at the International Conference for the Association of Experiential Education, October 8–11, in Alberta, Canada.

Henderson, K. E., Grode, G. M., O'Connell, M. L., & Schwartz, M. B. (2015). Environmental factors associated with physical activity in childcare centers. *International Journal of Behavioral Nutrition and Physical Activity*, *12*(1), 43.

Higgins, P. (2002). Outdoor education in Scotland. *Journal of Adventure Education & Outdoor Learning, 2*(2), 149-168. https://files.eric.ed.gov/fulltext/ED353112.pdf

Higgins, P. (2009). Into the big wide world: Sustainable experiential education for the 21st century. *Journal of Experiential Education*, *32*(1), 44-60

Higgins, P. & Nicol, R. (2013). Outdoor Education. In T. Bryce & W. Humes, D. Gillies and A. Kennedy (Eds.), *Scottish education - fourth edition* (pp.620-627). Edinburgh: Edinburgh University Press.

Hinds, J., & Sparks, P. (2008). Engaging with the natural environment: The role of affective connection and identity. *Journal of Environmental Psychology*, *28*(2), 109-120.

Irwin, D. (2008). Weaving the threads: Challenges encountered while educating for sustainability in outdoor education. *New Zealand Journal of Outdoor Education: Ko Tane Mahuta Pupuke, 2*(3), 36.

Jaakkola, T., Washington, T., & Yli-Piipari, S. (2013). The association between motivation in school physical education and self-reported physical activity during Finnish junior high school: A self-determination theory approach. *European Physical Education Review*, *19*(1), 127-141.

Kals, E., Schumacher, D., & Montada, L. (1999). Emotional affinity toward nature as a motivational basis to protect nature. *Environment and Behavior, 31*, 178-202. doi:10.1177/00139169921972056

Korpela, K., Kyttä, M., & Hartig, T. (2002). Restorative experience, self-regulation, and children's place preferences. *Journal of Environmental Psychology*, *22*(4), 387-398.

Kremer, J. M., Moran, A., Walker, G., & Craig, C. (2011). *Key concepts in sport psychology*. Sage: London

Kuo, M., Barnes, M., & Jordan, C. (2019). Do experiences with nature promote learning? Converging evidence of a cause-and-effect relationship. *Frontiers in Psychology, 10*, 305.

Lakin, L. (2013). *Developing independent learning in science: practical ideas and activities for 7-12 year olds*. (1 ed.) Maidenhead: Open University Press.

Liefländer, A. K., Fröhlich, G., Bogner, F. X., & Schultz, P. W. (2013). Promoting connectedness with nature through environmental education. *Environmental Education Research, 19*(3), 370-384.

Mace, B. L., Woody, W. D., & Berg, L. A. (2012). Teaching environmental psychology by doing it: Explorations in the natural world. *Ecopsychology, 4*(2), 81-86.

Malone, K. (2008). *Every Experience Matters: An evidence based research report on the role of learning outside the classroom for children's whole development from birth to eighteen years*. Report commissioned by Farming and Countryside Education for UK Department Children, School and Families, Wollongong, Australia.

Mannion, G., Mattu, L. & Wilson, M. (2015). *Teaching, learning, and play in the outdoors: a survey of school and pre-school provision in Scotland*. Scottish Natural Heritage Commissioned Report No. 779.

Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology, 24*(4), 503-515.

Niemiec, C. P., & Ryan, R. M. (2009). Autonomy, competence, and relatedness in the classroom: Applying self-determination theory to educational practice. *School Field, 7*(2), 133-144.

Nisbet, E. K., & Zelenski, J. M. (2011). Underestimating nearby nature: Affective forecasting errors obscure the happy path to sustainability. *Psychological Science, 22*(9), 1101-1106.

Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2009). The nature relatedness scale: Linking individuals' connection with nature to environmental concern and behavior. *Environment and Behavior, 41*(5), 715-740.

Nundy S., Dillon J. & Dowd P., (2009). Improving and encouragingteacher confidence in out-of-classroom learning: The impact of the Hampshire Trailblazer project on 3–13 curriculum practitioners, *Education 3–13, 37* (1), 61-73

O'Donnell, L., Morris M., & Wilson R., (2006). *Education outside the classroom: An assessment of activity and practice in schools and local authorities.* London: DfES

Ofsted., (2008) *Learning outside the classroom: How far should you go?* https://www.lotc.org.uk/wp-content/uploads/2010/12/Ofsted-Report-Oct-2008.pdf

Otto, S., & Pensini, P. (2017). Nature-based environmental education of children: Environmental knowledge and connectedness to nature, together, are related to ecological behaviour. *Global Environmental Change, 47*, 88-94.

Palmer, J. A., & Suggate, J. (1996). Influences and experiences affecting the pro-environmental behaviour of educators. *Environmental Education Research, 2(*1), 109-121.

Pretty J., Angus C., Bain M., Barton J., Gladwell V., Hine R., Pilgrim S., Sandercock S. &Sellens M., (2009). *Nature, Childhood, Health and Life Pathways*. Interdisciplinary Centre for Environment and Society Occasional Paper 2009-02. University of Essex, UK.

Ruimtelijk, M.-e. N. (2004). *Nature and Health: The Influence of Nature on Social, Psychological and Physical Well-Being.* The Hague: The Health Council of the Netherlands.

Ryan, R. M., & Deci, E. L. (2006). Self-regulation and the problem of human autonomy: Does psychology need choice, self-determination, and will? *Journal of Personality, 74*(6), 1557–1586. https://doi.org/10.1111/j.1467-6494.2006.00420.x.

Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. New York: Guilford Publications.

Schlechter, C. R., Rosenkranz, R. R., Fees, B. S., & Dzewaltowski, D. A. (2017).. Preschool Daily Patterns of Physical Activity Driven by Location and Social Context. *Journal of School Health, 87*(3), 194-199, doi:10.1111/josh.12486.

Scottish Government, (2018) *Out to Play - creating outdoor play experiences for children: practical guidance* Available at https://www.gov.scot/publications/out-play-practical-guidance-creating-outdoor-play-experiences-children/ (accessed 27 February 2019)

Scrutton, R. A. (2015). Outdoor adventure education for children in Scotland: Quantifying the benefits. *Journal of Adventure Education & Outdoor Learning, 15*(2), 123-137.

Stevenson, R. B., Brody, M., Dillon, J., & Wals, A. E. (2013). *International handbook of research on environmental education.* Routledge: London

Wells, N. M., & Lekies, K. S. (2006). Nature and the life course: Pathways from childhood nature experiences to adult environmentalism. *Children Youth and Environments, 16*(1), 1-24.

Williams, G. C., & Deci, E. L. (1996). Internalization of biopsychosocial values by medical students: A test of self-determination theory. *Journal of Personality and Social Psychology, 70*, 767-779

Williams, G. C., McGregor, H. A., Sharp, D., Levesque, C., Kouides, R. W., Ryan, R. M., & Deci, E. L. (2006). Testing a self-determination theory intervention for motivating

tobacco cessation: Supporting autonomy and competence in a clinical trial. *Health psychology*, *25*(1), 91.

Ulset, V., Vitaro, F., Brendgen, M., Bekkhus, M., & Borge, A. I. H. (2017). Time spent outdoors during preschool: Links with children's cognitive and behavioral development. *Journal of Environmental Psychology*.

University of Edinburgh (2016) *Outdoor Learning in Scotland: Issues for Education* https://www.ed.ac.uk/files/atoms/files/electionbriefing5-outdoor-learning-29-03-16.pdf

Zylstra, M. J., Knight, A. T., Esler, K. J., & Le Grange, L. L. (2014). Connectedness as a core conservation concern: An interdisciplinary review of theory and a call for practice. *Springer Science Reviews*, *2*(1-2), 119-143.

Appendix vi

Co-authorship form 1

The University of Dundee Education and Social Work PhD by Publication

Verifiable account of contribution to published works

Barrable, A., & Arvanitis, A. (2018). Flourishing in the forest: looking at Forest School through a self-determination theory lens. *Journal of Outdoor and Environmental Education*, *22*(1), 39- 55. https://doi.org/10.1007/s42322-018-0018-5
First author: Alexia Barrable

Second author: Dr Alexios Arvanitis

Brief description of role in output/activity: The first author came up with the concept, drafted the first outline and led the literature search. The first author drafted the final version of the article. The second author read and advised on second draft and on additional literature. Both authors worked on revisions and approved the final version of the article.

First author signature: ..... Date: 17/09/19

Second author signature: .... Date: 13/10/19

Co-authorship form 2

The University of Dundee Education and Social Work PhD by Publication

Verifiable account of contribution to published works

Barrable, A., & Lakin, L. (2019). Nature relatedness in student teachers, perceived competence and willingness to teach outdoors: An empirical study. *Journal of Adventure Education and Outdoor Learning*. https://doi.org/10.1080/14729679.2019.1609999

First author: Alexia Barrable

Second author: Dr Liz Lakin

Brief description of role in output/activity: The first author came up with the research design, scales that were used and analysis of results in this quantitative study. She also applied for ethical approval using the university procedures. The second author undertook the practical sessions, while the first author collected, analysed and reported on the data. The first author drafted the paper, while the second author gave feedback on it. Both authors gave approval for the revisions made by the first author, and approved the final version of the manuscript.

First author signature: ..... Date: 17/09/19

Second author signature: ..... *E. Lakin*..... Date: 24/09/19